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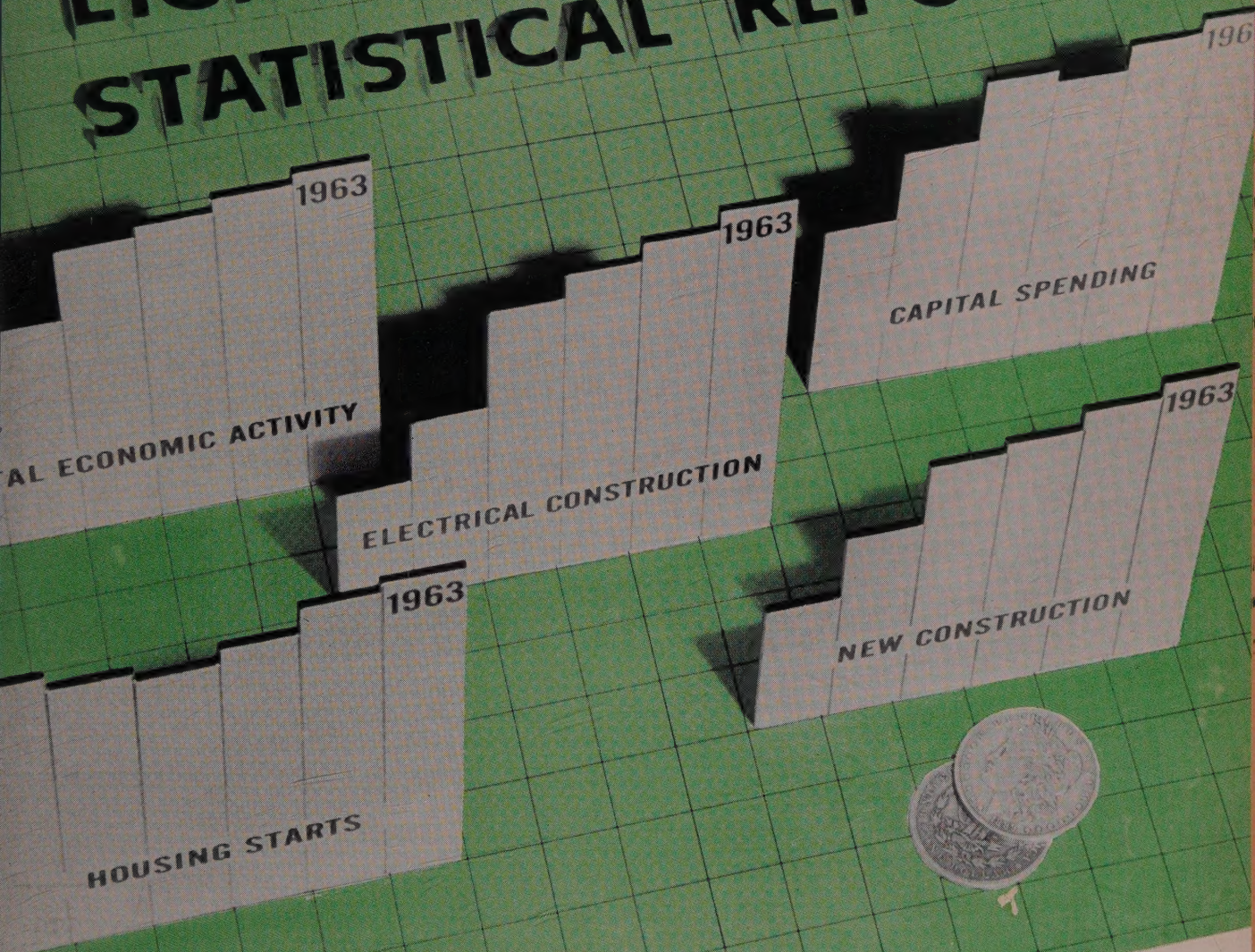
# ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING

AMES FILE

COPY No. 2

## EIGHTH ANNUAL STATISTICAL REPORT



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61ST YEAR



beat  
the heat  
with  
self-cooling  
action



new  
**GUTH**  
**\*PRISMAROUND**

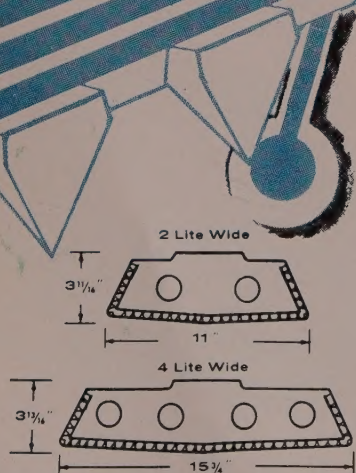
the cool new beauty engineered to disperse lamp and ballast heat. The new, improved PRISMROID\*\* Louver-Lens consists of hundreds of open prisms that breathe and allow air to circulate freely. Here's the result:

| Luminaire           | Max. Ballast-Case Temp. | Max. Capacitor Temp. | Max. Coil Temp. | Total Watts to lamps & Ballasts |
|---------------------|-------------------------|----------------------|-----------------|---------------------------------|
| 4/40W "PRISMAROUND" | 85° C.                  | 67° C.               | 101° C.         | 184.1W                          |
| 4/40W "Brand-X"     | 110° C.                 | 92.5° C.             | 127° C.         | 158W                            |

Cooler operation means longer life for lamps and ballasts and gives you 10-15% additional foot candles for your money. Extra thick  $\frac{3}{8}$ " Prismaround plastic withstands more abuse, minimizes breakage and warpage.

Furnished in 2 light and 4 light widths, 4' and 8' lengths all with super-hard, gleaming white Acrylic finish.

send for your free copy of Prismaround folder #31



\* T.M. AND PATS. PEND.

\*\* ® U.S. PAT. NO. 2,904,673

THE EDWIN F. GUTH CO., 2615 WASHINGTON BLVD., BOX 7079, ST. LOUIS 77, MO.



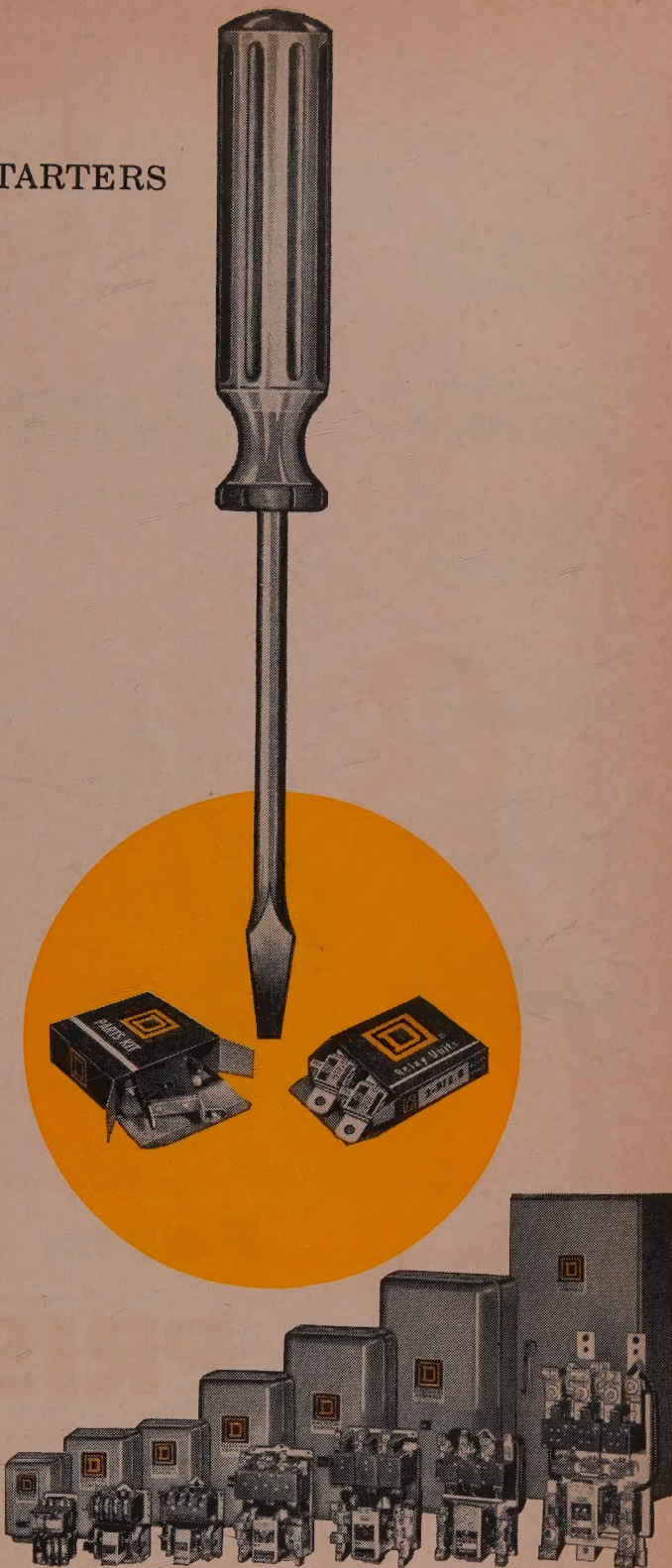
*a down-to-earth talk about* MOTOR STARTERS

## how high do you rate **VERSATILITY?**

● When you're comparing motor starters, it makes sense to work against a check list of important design and performance features. High on such a list is versatility—and on this point, Square D ranks number one for several reasons...

No other starter is so easy to modify—all you need is a screwdriver, one of Square D's parts kits and a couple of minutes. It's a breeze to add electrical interlocks (up to four double-circuit units), all front-connected. You can change thermal elements on overload relays to match motor changes—in seconds. It's easy to add a cover-mounted push button, pilot light or selector switch.

Versatility is one of several areas in which Square D starters have more to offer.



For the complete story, write for Bulletin SM-293 describing Class 8536 Starters  
Square D Company, Dept. SA, 4041 North Richards Street, Milwaukee 12, Wisconsin



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*wherever electricity is distributed and controlled*



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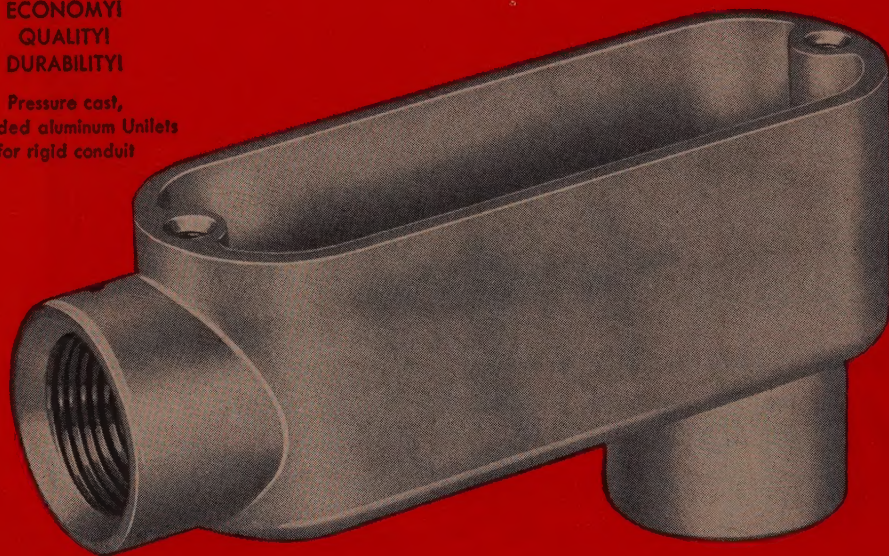
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# ELECTRICAL CONSTRUCTION AND MAINTENANCE

with which is consolidated Electrical Contracting. The  
Electrict and Electrical Record . . . Established 1901

Published for electrical contractors, electrical departments  
in industry, engineers, consultants, inspectors and motor  
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nance and management in the field of electrical construc-  
tion and maintenance.

61ST YEAR • SEPTEMBER 1962

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# ELECTRICAL CONSTRUCTION AND MAINTENANCE

SEPTEMBER • 1962 continued

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Now, inside as well as out, Bronco 66 Certified types W and G cables are given all the protection modern science and technology can provide for a portable 600 volt cable. To the 67.32% neoprene outer protecting jacket—still the highest content in the industry—is added the inner protection of Bronco XL Butyl insulation. XL Butyl is markedly superior to ordinary rubber insulation in its resistance to aging, moisture, ozone, corona cutting, and especially to heat. It has much better electrical properties. We believe Bronco XL Butyl is in all respects the finest insulating material available for use in portable cables.

Butyl-insulated Bronco 66 is not a "special"; not an alternate vaguely "available." You don't have to ask for Butyl, just ask for Bronco 66. Virtually all of the vast stock now in the Bronco nationwide network of Servicenters is insulated with Butyl. What's more, the addition of XL Butyl to Bronco 66 does not increase its cost to you by one cent.

**RATED FOR 85°C COPPER CONDUCTOR TEMPERATURE** Probably the biggest advantage to the user of XL Butyl is the 85°C ampacity rating of Bronco 66 W and G cables. This means that, compared to a 75°C-rated rubber-insulated cable, a greater current load can now be carried by a conductor of given size. Conversely, with a conventional load, a tremendous safety margin is built in to protect the cable from temporary overloads.

**PURCHASER CAN SAVE UP TO 20%** When you inspect the 85°C ampacity tables, you will see that an awg size 2, three-conductor XL Butyl-insulated Bronco 66 cable will carry the same load as a size 1 with HR insulation. The savings are about twenty percent. In smaller sizes also, a cable one or two awg sizes smaller occasionally may be used.

XL Butyl insulation gives you one more compelling reason for always insisting on the best—Bronco 66 Certified.

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Los Angeles 58, California

Please rush sample, new ampacity table, and complete information on your new XL Butyl-insulated Bronco 66 Certified 600-volt electrical power cables.

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## LUMADRAMA

Independence Hall in Philadelphia has been equipped for a spectacular sound and light drama in which sophisticated floodlighting techniques are coordinated with a program of music and voices devoted to the history of the structure. It is the first of many national shrines which will be similarly equipped. The exacting electrical installation was made by E-J Electric Installation Co. of New York. Associate Editor John H. Watt describes the work in "Independence Hall Echoes the Past" beginning on page 112.

## STATISTICAL SUMMARY

Our annual statistical summary depicts generally favorable trends in the economy and in the electrical industry. Associate Editor Berlon C. Cooper's analysis may be summed up as cautiously optimistic for the immediate future with no significant change in the healthy growth pattern of the electrical industry in prospect. His report "Sound Growth in Electrical Markets" begins on page 91.

## CONTROL INSTALLATIONS

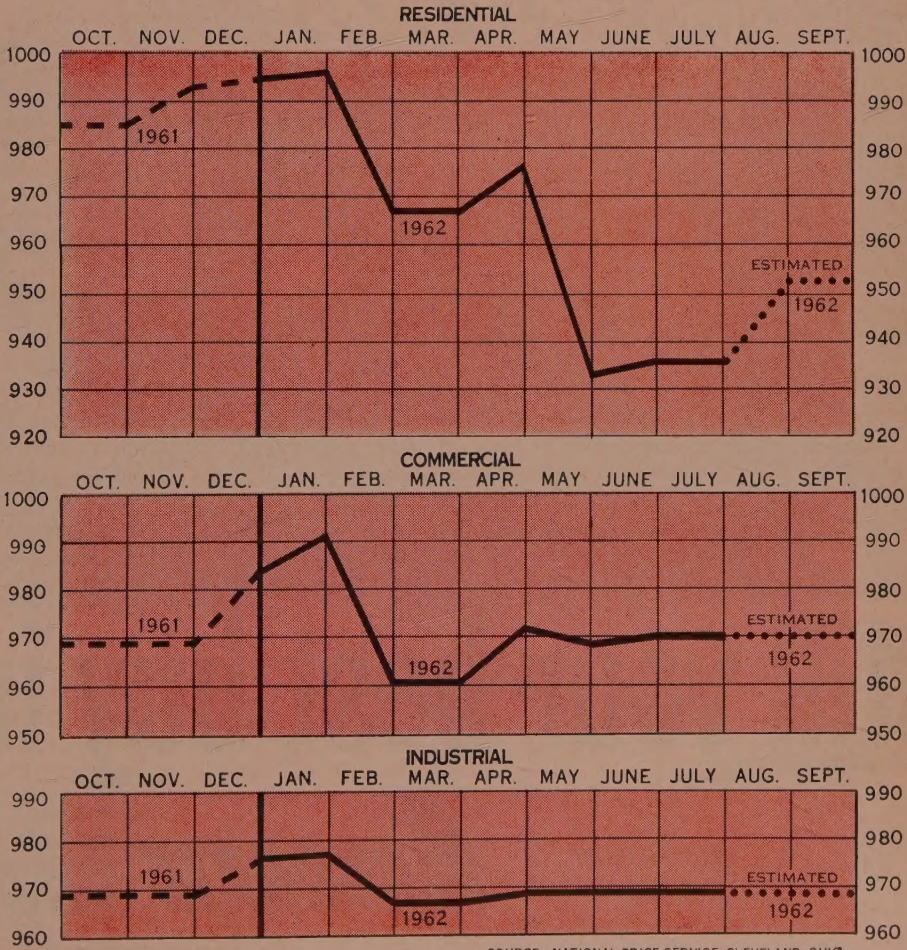
The relative merits of different types of control installations are often argued but rarely subjected to objective analysis. William H. Younger of Allen Bradley initiated and directed a critical study of a practical control layout comparing separate switches and controls, combination controllers and control centers. His report discloses comparative installed costs for the project, and enumerates ten of the most common influencing criteria in the selection of components. "Selecting Motor Control Systems" begins on page 107.

### ELECTRICAL MATERIALS COST INDEX

CHANGES IN THE COST OF ELECTRICAL MATERIALS FOR EACH OF THREE TYPICAL JOBS ARE SHOWN ON THESE THREE CHARTS.

THE BASE (1000) REPRESENTS THE AVERAGE COST OF THE MATERIALS FOR THE YEAR 1960

THE MONTHLY INDEX POINTS SHOW THE VARIATIONS IN COST ON THE FIRST OF EACH MONTH.



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ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . SEPTEMBER, 1962



# Washington Report

SEPTEMBER • 1962

**Last month President Kennedy decided against a quick tax cut** as a means of spurring economic growth, which many of his advisers and others has recommended. His decision was made following the availability and review of July statistics on major economic barometers. The July figures did not justify a "crisis atmosphere," according to the President, but instead showed:

- Another new record in industrial production (an FRB Index of 119% of 1957 equal to 100%).
- A new reduction in unemployment (to four million, or 5.3% of the total labor force).
- A significant rebound in retail sales (\$19.5 billion seasonally adjusted), up from \$19.1 billion in June.

In addition, the President gave some reasons for his "confidence in the economy, such as:

- The stock market "rests on a sounder basis" after its nosedive in May and June.
- Inflation "remains no longer a serious threat."
- Progress is being made in halting the outflow of gold and dollars.

Whether it is cause-and-effect, or pure coincidence, the economy has lacked vigor since the stock market break at the end of May. Economists, businessmen, politicians or others can each make out a case for his position on the economy—1) recession, 2) high-level stagnation, 3) continuing slow improvement.

**Construction spending in July was down from the June rate**, but still was at the second highest annual rate on record—\$61,655 million in July, versus the record \$62,474 million in June. July spending was 8% greater than for the same month a year earlier. The Commerce Department's official prediction for 1962 is \$60 billion. The actual new construction spending in July was \$5.7 billion, off about 1% from the June actual figure. Total new private construction outlays in July were \$4,061 million, off 1% from June spending, while public construction spending totaled \$1,645 million, off 3% from June.

**Commerce Department released \$2 billion in August to spur highway construction**, but only about a dozen states have completed planning and are eligible for these additional funds. The move was obviously one to help spur the economy, making \$5.8 billion of Federal aid available in the Government's fiscal 1963 rather than the previously planned \$3.8 billion.

**The nation's airports have been allocated \$74 million in Federal aid**, for the current fiscal year beginning July 1, it was recently announced by Federal Aviation Agency. The aid funds will go to 419 of the nation's airports. Generally speaking, local communities match the Federal grants on a 50-50 basis.

**Home construction activity declined slightly in July**, to a seasonally adjusted annual rate of 1,407 thousand new private housing units, off 0.5% from the June rate. The annual rate of all private housing starts in the first seven months of this year averaged just under 1.4 million units, which is 25,000 units below the Dept. of Commerce's forecast for the year.

**The U. S. gold reserve declined \$742 million during the first seven months of 1962**, leaving \$16,148 million on hand. The total outflow of gold in all of 1961 was \$877 million.





PHOTO-DIAGRAM OF HORIZONTAL CROSS SECTION  
SHOWS WIDE LATERAL LIGHT DISTRIBUTION





# Revolutionary new "Cat's-Eye" Floodlight\* gives widest usable beam

## Narrowest floodlight delivers widest horizontal beam plus controlled vertical distribution

The widest usable floodlight beam available today is produced by the narrowest reflector. This seeming paradox of design in Revere's revolutionary new 400-watt mercury luminaire, the CAT'S-EYE, is explained by the photo-diagram at the left and its adjacent caption. The unit achieves an extremely wide lateral beam spread. A similar demonstration through a vertical cross section would reveal carefully controlled vertical light distribution.

Beam spreads and efficiencies are given in the table below. Notice that efficiency figures are *beam efficiencies* and that changes in the vertical distribution may be achieved without appreciably affecting the wide lateral distribution.

| 400-Watt<br>Mercury<br>Lamp | Horizontal<br>Beam<br>Spread | Vertical<br>Beam<br>Spread | Beam<br>Efficiency |
|-----------------------------|------------------------------|----------------------------|--------------------|
| Clear                       | 158°                         | 39°                        | 57%                |
| Phosphor-Coated             | 164°                         | 80°                        | 61%                |

Prior to the invention of the CAT'S-EYE, a light pattern of wide lateral and controlled vertical distribution could be obtained only with a point source in combination with a Fresnel lens. This new Revere floodlight achieves such distribution with high utilization by means of a unique combination of elliptical and parabolic reflector contours.

The controlled beam of the CAT'S-EYE puts more light where you

want it and makes possible efficient, economical lighting of parking lots, sports areas, loading ramps, and building fronts. Now you can light wide areas with fewer floodlights and attain higher intensities than with conventional units.

We expect that there may be questions about the ability of so narrow a floodlight to produce such a wide beam. To answer these questions our representatives will welcome the opportunity to supply photometric data and to arrange a demonstration that will let this remarkable luminaire speak for itself.

The handsome CAT'S-EYE is internally wired with no cords or wires exposed to view. It is sturdy and



**FRONT VIEW** of Revere CAT'S-EYE illustrates slender, upright contour. Unique shape results from use of reflector with elliptical horizontal cross section that produces the widest usable beam of any floodlight.

weatherproof and is designed for long, trouble-free service and easy installation. A degree-marked fitter and built-in sights assure accurate aiming. The narrow shape permits compact mounting of the floodlights in multiple installations, and accessories are available for pole-top, cross-arm, pipe, or wall mounting.

A combination fitter-housing encloses a choice of constant-wattage or reactor-type ballasts for common primary voltages. A fitter without the housing and integral transformer is used with remote ballasts.

For more information on how you can widen your outdoor lighting horizons with the CAT'S-EYE, send for your copy of Bulletin No. 100-49.



**SIDE VIEW** shows parabolic contour of luminaire's vertical cross section which produces controlled vertical beam spread. Combination fitter-housing below the reflector encloses transformer for mercury lamp.

**PHOTO-DIAGRAM** shows wide lateral distribution of light. Line drawing of Revere CAT'S-EYE is superimposed on photograph of reflector's horizontal cross section. (Note: Special light source is here surrounded by slotted shield to produce ray trace that represents light flux in this laboratory demonstration.) Light control is achieved solely by the compound elliptical reflector. Special heat-resistant convex lens is contoured to prevent internal reflections and to provide maximum light transmission. The lens provides weathertight cover.

\*Patent applied for.

# Revere®

## OUTDOOR LIGHTING

REVERE ELECTRIC MFG. CO.

7420 Lehigh, Chicago 48 (Niles), Illinois

TELEPHONES: Area Code 312, Niles 7-6060;

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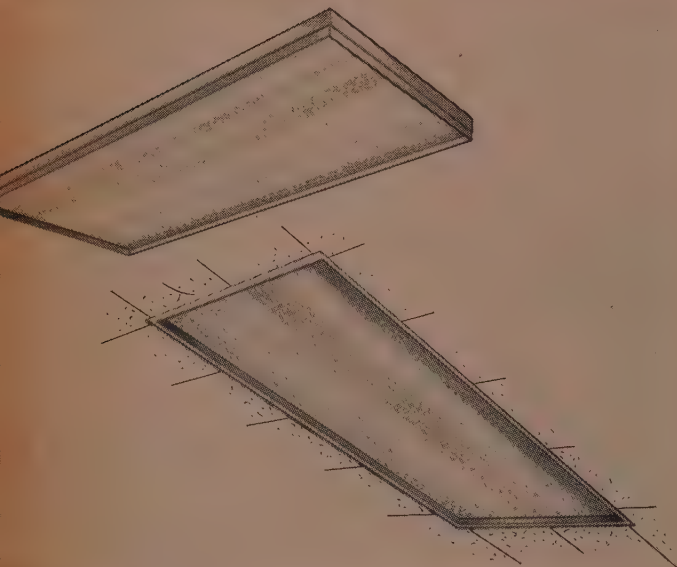
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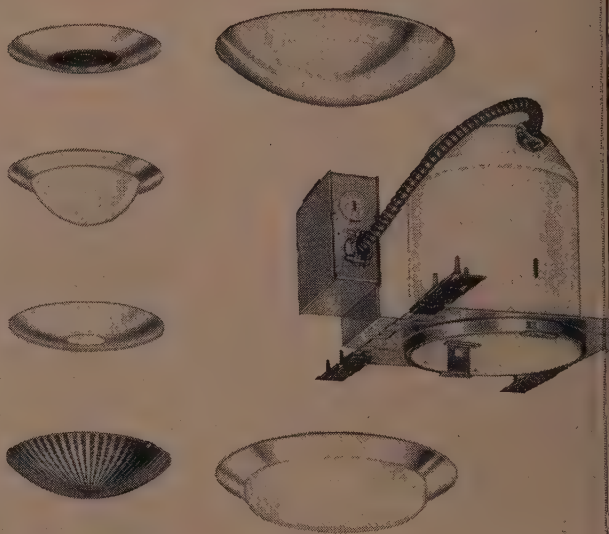
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Graybar's Lighting Action Plan helps you get it! Graybar gives you the tools for selling...quality lighting equipment, priced to fit every budget...available from your local Graybar stocks. Also, you're able to offer financial help through Leased Lighting—at no risk or cost. And...you have all of Graybar's know-how for help in planning, layout and specification. It's all in the Graybar Sales Kit which

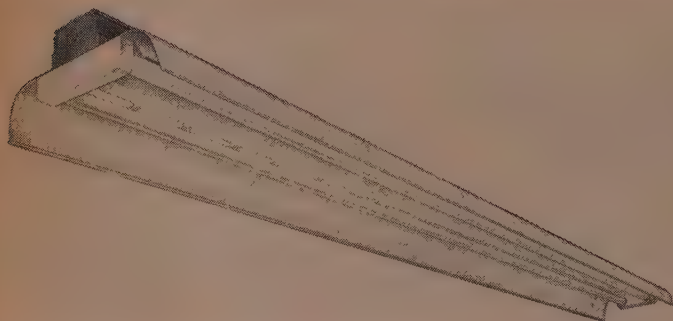
includes such helpful items as a complete Lighting Prospect Plan Book, Light Meter, Lighting Selector and other sales aids. But time is money—your money, so act now on the Action Plan. Ask your local Graybar man, or write for the Action Plan, Graybar Electric Company, Inc., 420 Lexington Avenue, N. Y. 17, N. Y. and...call Graybar for everything electrical. **Graybar**



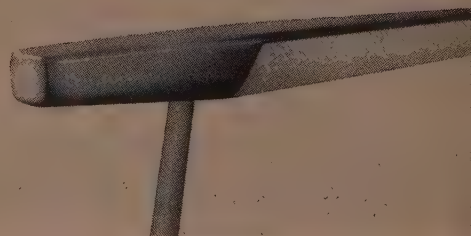
**BENJAMIN:** Outstanding style and economy in Benjamin's Modular-Troffer for recessed or surface mounting; Prismatic Lens or 1/2" Cube Plastic Louver. Fixture is one-piece steel housing; baked enamel finish. Suggested user price \$29.60 with two 40 W Rapid Start Lamps, \$47.65 with four lamps. Troffers at slight additional cost in flange construction with integral swing-out hangers.



**MOE LIGHT:** Prewired Adjust-All round recessed housing with choice of 40 decorator combinations of Open Trim, Trim-and-Glass and Decorative Glass including satin brass or aluminum, chromium, baked enamel, polished brass, Fresnel lenses, opal glass, white glass, etched glass.

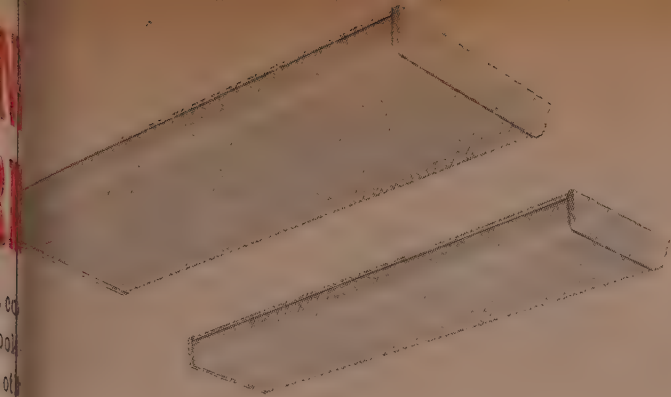


**KEYSTONE RLM FEATURE-LITE INDUSTRIAL:** Here's top efficiency lighting with 12% upward component, lifetime porcelain enameled reflectors and high power factor fused ballasts. In 4-foot, 2-lamp Rapid Start suggested user price \$21.65; 8-foot, 2-lamp Slimline suggested user price \$36.65.

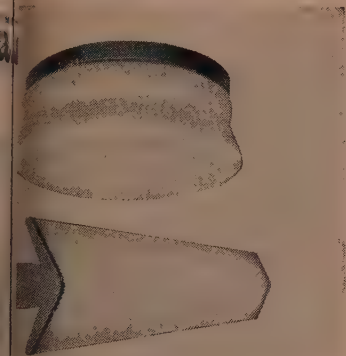


**GE POST MOUNTED FLUORESCENT:** Sturdy aluminum housing with acrylic plastic light diffusing globe and aluminum reflector. Internally prewired for quick, easy installation; optional photocell electric control available. Suggested user price \$130.00, photocell control, \$138.00.

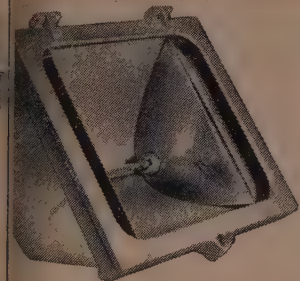




**WAKEFIELD PRISMATIC:** Popular, practical, inexpensive Wakefield Prismatic luminaire has  $\frac{1}{8}$ " thick clear lens diffuser of styrene, easily removed without tools. Prismatic 50 has two Rapid Start lamps for 50 footcandles —suggested user price of \$20.75; Prismatic 100 uses four lamps for 100 footcandles at \$34.75.



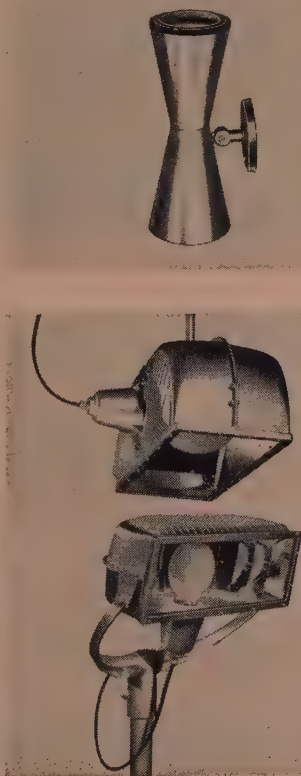
**LITECRAFT VALULITE:** Fixtures that feature beauty in opal glass and anodized aluminum; hinged ceiling drums for easy relamping. With two 75 W lamps, suggested user price \$6.40, three 100 W lamps, \$10.00. ■ Litecraft also features fluorescent fixture with reversible plastic diffuser for horizontal or vertical mounting on wall or ceiling. Suggested user price with 40 W Rapid Start, \$13.35.



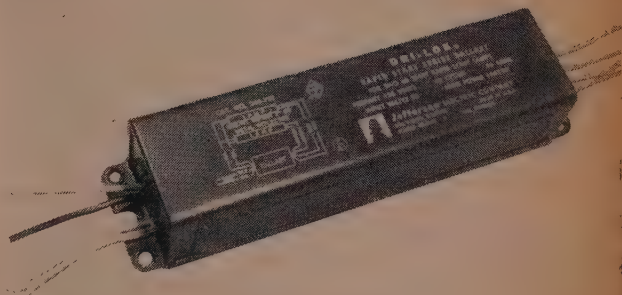
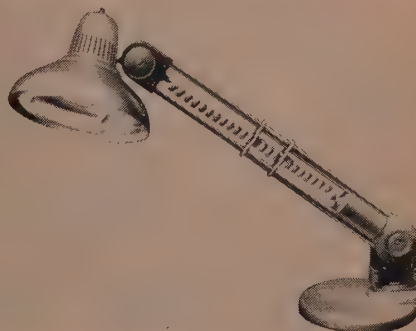
**MOLDCAST HOUR GLASS:** Modern design in cast aluminum fixtures for sealed beam lamps. The Hour Glass is the only cast aluminum, weatherproof fixture of its kind, complete with protective lens and canopy plate. Satin aluminum finish protected by clear plastic coating. Suggested user price \$25.17.

**ANTHONY "THRIFTY-Q":** Cool, controlled Quartz-Iodine lighting. Cast aluminum fixture for rapid heat dissipation; high-temperature Neoprene gaskets. In two models; 500W/120V, suggested user price \$30.65 and 1500W/277V \$38.65.

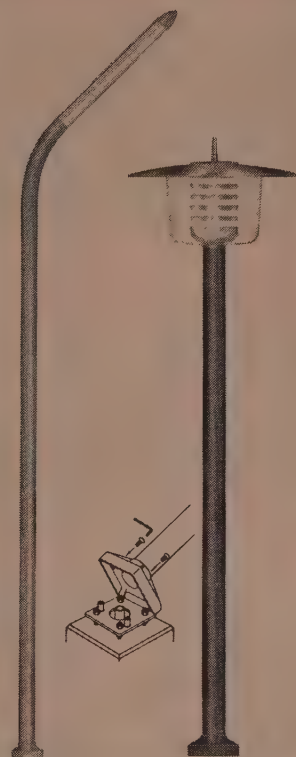
**WIDELITE:** For 100, 175, 250, 400 and 1000 W color-corrected mercury vapor lamps, quartz-iodine lamps or incandescent lamps, or in combination. Die-cast aluminum bodies resist corrosion and damage; heat dissipating fins promote longer operating life. May be mounted on walls, poles or hung; in single or multiple units. Choice of reflectors for different beam coverage. Available in all voltages at suggested user prices from \$42.00.



**AMPLEX:** Advanced lighting uniquely combining fluorescent and incandescent. Instantly adjustable lamp, high quality light for office, plant or laboratory...in clamp-on, screw-down or draftsman-clamp mounts. Suggested user prices from \$27.40.



**JEFFERSON DRI-LOK:** Ends danger of compound leakage. Dri-Lok is a new thermo-setting plastic, bonding ballast core, coil and case into one unit. Will not react or combine chemically with any material in ballast. Ballast operates cooler for longer operating life.



**STERNER LIGHTING:** Lowest installed cost per lumen output of any outdoor fluorescent. Davit lights are complete down to mounting bolts, internally wired with HPF ballast in base for easy servicing through patented "Hinge-O-Matic", allowing one-man relamping and low-cost initial installation. Pole and lamp are fastened to base with heavy-duty hinge for quick manipulation. In natural aluminum or anodized finish. Suggested user prices range from \$377.00 to \$472.00, including poles and all equipment. Also available in double-davit construction. ■ Circa-Lite also features exclusive "Hinge-O-Matic" for ease of installation and maintenance. Suggested user prices from \$268.00 to \$535.00, including poles.

Here is part of the wide selection of fixtures we carry...  
in stock at Graybar...headquarters for lighting and lamps





**Sheath**—premium grade P.V.C.

**Cable Tape**—Mylar®

**Fillers**—non-wicking plastic

**Insulation**—high density polyethylene

**Coding**—Type A: white printed code  
on black—IPCEA Method #3  
Type B: spiral stripes  
on color background—IPCEA Method #1

**Covering**—heat stabilized Nylon®

**Conductor**—stranded tinned copper

®reg. DuPont trademark

## New Rockbestos 90°C Plastic Control Cable Offers maximum circuit reliability

Rockbestos PNR X-90, 600 volt, plastic control cable was designed specifically to provide maximum circuit integrity under extreme environmental conditions...resulting in lower cost per service hour.

Suitable for aerial, conduit or direct burial service at temperatures from -67°F to +195°F, PNR X-90 features a number of other important advantages due to its unique construction. It has excellent resistance to

heat distortion, cold flow, environmental stress cracking, temporary overload conditions and exposure to most chemicals and oils.

We invite you to compare the construction features and physical and electrical properties of PNR X-90 with IPCEA requirements listed on the opposite page or *with any competitive plastic cable*. See for yourself how extra quality and extra reliability, are designed into Rockbestos PNR X-90 plastic control cable.



## Physical Properties of PNR X-90 Exceed IPCEA Specifications

| ROCKBESTOS PNR X-90                   | I.P.C.E.A. S-61-402     | ADVANTAGES PNR X-90                                                                                                            |
|---------------------------------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Coated conductors                     | Uncoated                | Quicker soldered connections. Cleaner, more positive pressure connections.                                                     |
| High Density PE insulation            | Regular PE              | Tougher, crack-resistant, better heat and cold resistance.                                                                     |
| Nylon insulation covering             | Optional                | Better abrasion—, heat—, and chemical-resistance.                                                                              |
| Non-hygroscopic, non-fibrous fillers  | Material not specified  | No moisture wicking.                                                                                                           |
| Mylar cable tape                      | Not required            | Rounder cable—easier to handle, cleaner. Tape improves flexibility, augments jacket toughness, and serves as chemical barrier. |
| Premium PVC jacket, 90% concentricity | General purpose PVC—80% | Tougher, better heat distortion resistance, improved cold resistance, flexibility and resistance to wear.                      |

## Electrical Test Results also Prove Superiority of PNR X-90

| TESTS                             | I.P.C.E.A. S-61-402 | ROCKBESTOS RSS-3-201 | TYPICAL VALUES |
|-----------------------------------|---------------------|----------------------|----------------|
| <b>POLYETHYLENE INSULATION</b>    |                     |                      |                |
| Original:—tensile, psi            | 1400 min.           | 2800 min.            | 3,100          |
| —elongation, %                    | 350 min.            | 250 min.             | 300            |
| <b>NYLON COVERED CONDUCTOR</b>    |                     |                      |                |
| Dielectric strength: (X-90)       |                     |                      |                |
| Heat distortion—10#, 115°C 24 hr. | —                   | 12,000v. min.        | 22,000v.       |
| Cold flow—50#, RT, 24 hr.         | —                   | 20,000v. min.        | 50,000v.       |
| Tank—6 hr. water #12—600v.        | 3000v. min.         | 3,000v. min.         | OK             |
| Insulation Resistance K—          |                     |                      |                |
| 6 hr. in water                    | 30,000 min.         | 50,000 min.          | OK             |
| SAE20 oil, 70°C., 4 hr:           |                     |                      |                |
| PE tensile, % of original         | —                   | 90 min.              | 93             |
| PE elongation, % of original      | —                   | 90 min.              | 92             |
| Cold blend—55°C., 1 hr.           | No cracks           | No cracks            | OK             |
| <b>SHEATH</b>                     |                     |                      |                |
| Original: tensile, psi            | 1500 min.           | 1900 min.            | 2,500          |
| elongation, %                     | 100 min.            | 175 min.             | 275            |
| SAE20 oil, 70°C., 4 hr:           |                     |                      |                |
| tensile, % of original            | 80 min.             | 85 min.              | 96             |
| elongation, % of original         | 60 min.             | 85 min.              | 92             |
| Heat distortion, 121° C           |                     |                      |                |
| 1 hr.:—%                          | 50 max.             | 30 max.              | 14             |

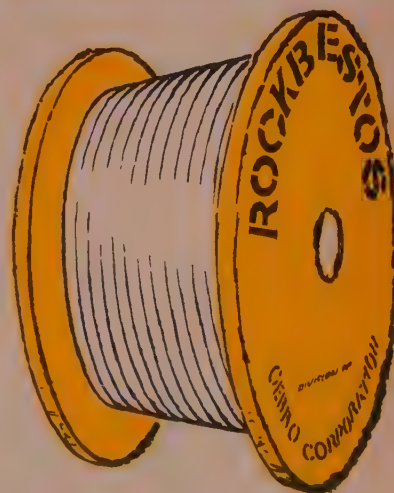
Here's another fact worth remembering... the serviceability of the basic plastic construction of PNR X-90 cable has been proved in two ways: in the millions of feet of regular, small-diameter PNR cable used in hundreds of installations since it was introduced in 1948, and in its adoption by military specification for severe environmental conditions.

On your next critical control circuit installation specify Rockbestos PNR X-90 for extra reliability.

## ROCKBESTOS WIRE & CABLE CO.

DIVISION OF CERRO CORPORATION

MAIN OFFICE AND FACTORY: Nicoll and Canner Streets, New Haven, Conn.





# NEW

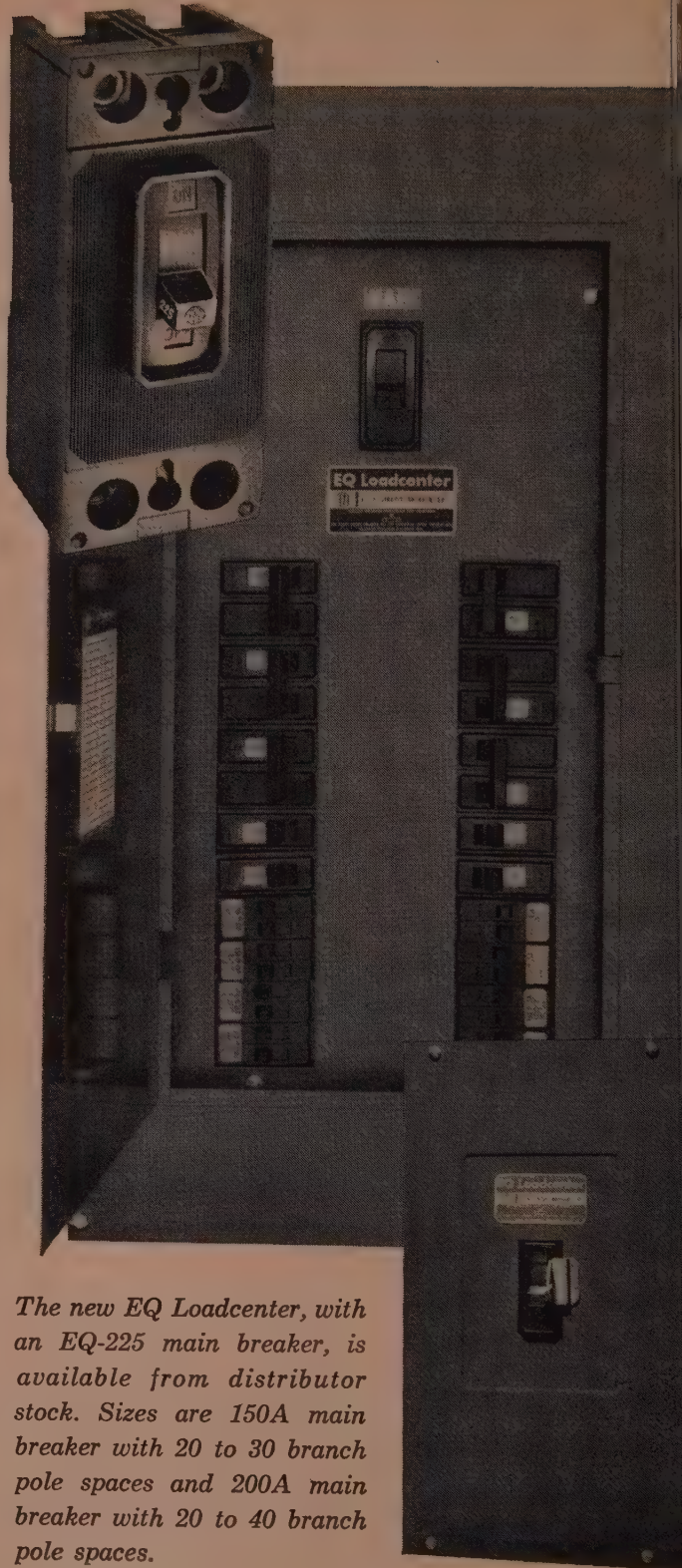
## EQ-225 AMP. BREAKER

# SAME

## FAMOUS I-T-E QUALITY

Now available under the I-T-E label are the new EQ-225 circuit breaker, new EQ-Loadcenter with 150A or 200A main breaker, and enclosed EQ-225 breakers . . (NEMA Type 1, 1B and 3) . . in ratings of 125, 150, 200 or 225 amperes. These new modern, compact devices provide positive protection against overload or short circuit conditions. The EQ-225 employs Quick-make, Quick-break, Trip-free mechanism action with common trip (not companion trip). A fault to ground automatically opens both poles of the breaker! Overcurrent protection combines the time proven thermal magnetic principle for positive protection against overload or fault conditions. For additional information, contact your nearest I-T-E District Office, or your local I-T-E Authorized Distributor.

New EQ-225 AMP BREAKER  
2 POLE 120/240 VOLTS A-C  
125-225 AMPERES



*The new EQ Loadcenter, with an EQ-225 main breaker, is available from distributor stock. Sizes are 150A main breaker with 20 to 30 branch pole spaces and 200A main breaker with 20 to 40 branch pole spaces.*

**for the Contractor who is Proud of his work**



# I-T-E CIRCUIT BREAKER COMPANY



*Twice the work in half the time!*

# Bull Dog

## PLASTIC ELECTRICAL TAPE



Does the work of rubber tape *and* friction tape! Saves time with swift once-only splicing . . . looks better, lasts longer because it sticks and *stays*, conforming to any shape. Low bulk makes it especially good for neat, close tolerance work. Won't creep or thin in wide range of temperatures. Costs no more. Anyway you look at it, BULL DOG VINYL PLASTIC is economy all around! BULL DOG (.007" thickness) has minimum dielectric strength of 10,000 volts.



*There's a BULL DOG TAPE for every purpose*

- Friction
- Rubber
- Plastic

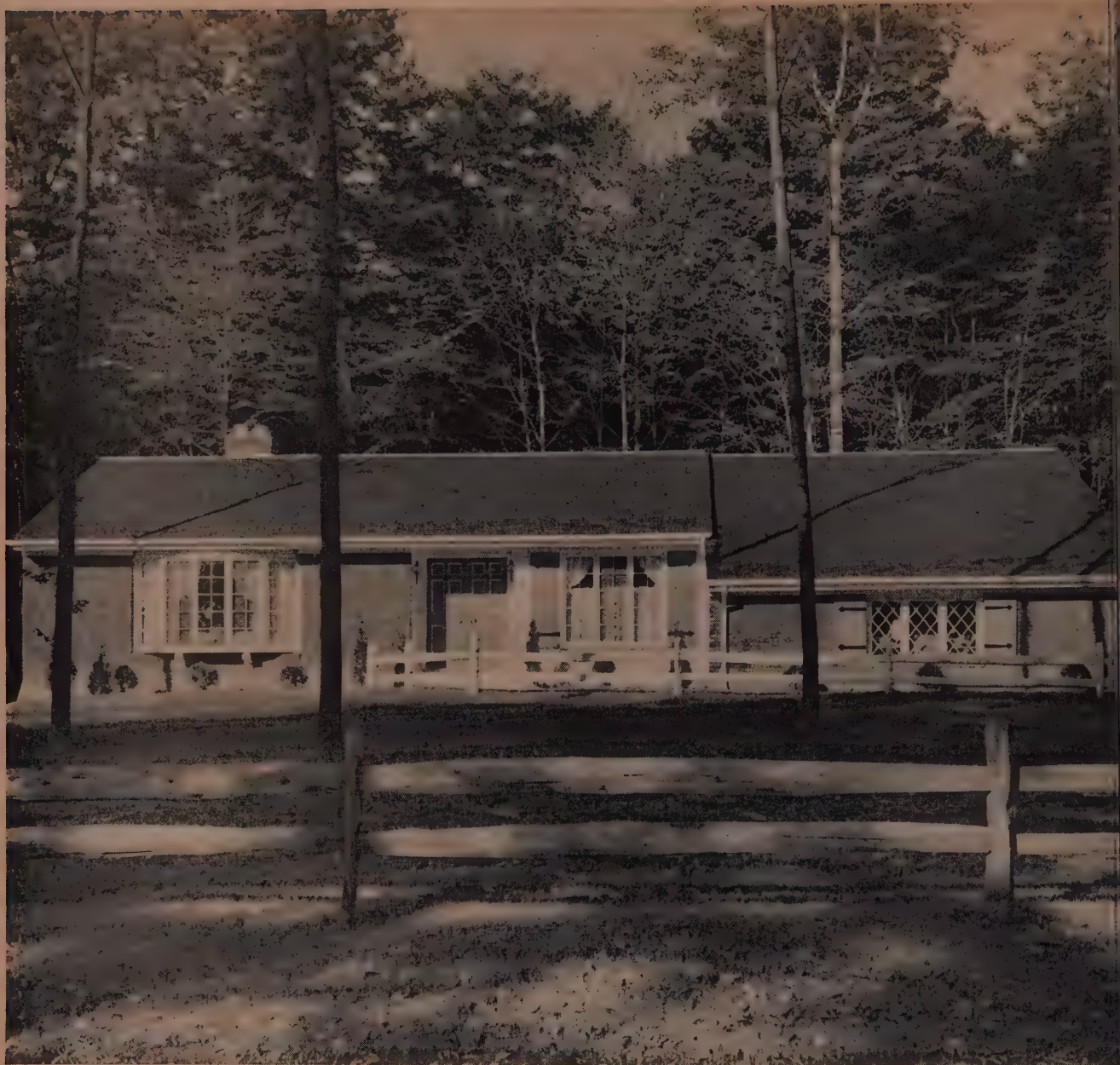
**Sold only  
through verified  
wholesalers**



**AMERICAN BILTRITE RUBBER COMPANY  
BOSTON WOVEN HOSE & RUBBER DIVISION  
BOSTON 3, MASSACHUSETTS**

**BOSTON**





Natural wooded settings and dramatic indoor-outdoor lighting ideas are features of the Kenwood Gardens homes in the Cleveland suburb of Gates

## In Cleveland, Ohio, this house sells for \$40,900

*("...and convenience features like concealed telephone wiring help me sell it," says John Koerber of Kenwood Builders)*

"Concealed telephone wiring is one of the best investments a builder can make in gaining the confidence and respect of his prospective customers," says John Koerber, Kenwood Builders, Inc.

"The Telephone Company comes in and makes a clean, quick installation while the home is being built. There's no trouble or time loss for

the builder—and telephone rewiring is a great convenience for the buyer. Having concealed telephone wiring in our homes gives us a real sales talking point."

Kenwood Builders is currently constructing 54 custom homes in the Kenwood Gardens suburb of Cleveland, Ohio. The homes range in price from \$38,000 to \$60,000.



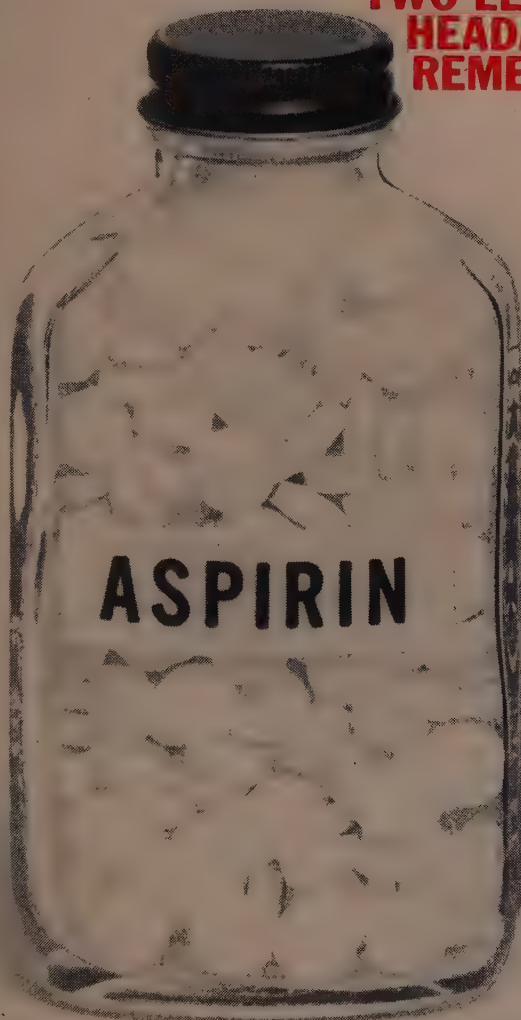
Your Bell Telephone Business Office will help telephone plan your homes. For details on home installation see Sweet's Light Construction File, 11c/Be. For commercial installations, Sweet's Architectural File, 33a



### BELL TELEPHONE SYSTEM



**TWO LEADING  
HEADACHE  
REMEDIES**



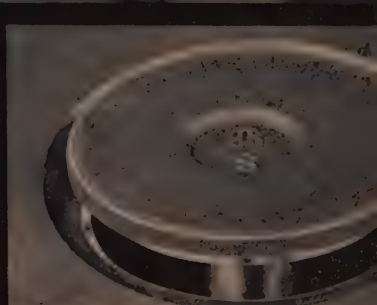
Amprobe snap-around volt-amp-ohmmeters clear up nagging electrical servicing problems faster than pills get into the bloodstream in a tv commercial. That's because Amprobes work three ways to bring instant "relief" to electricians and maintenance men. They use the RS-3 as a **voltmeter** to determine low- or high-voltage conditions (3 ranges: 0-150/300/600 v AC); as an **ammeter** to balance circuits, set relays, take load surveys (5 ranges: 0-5/15/40/100/300 amps AC); and as an **ohmmeter** to measure resistance and check for continuity, opens and shorts (1 range: 25 ohms mid-scale). The RS-3's rotary scale ensures error-free readings; its pointer lock enables you to work with either hand — even when the conductors being tested are hard to get at. No wonder more Amprobes are in use today than all other similar instruments combined. The RS-3 sells for \$52.50. Other Amprobes start at \$19.85. At your distributor.



**AMPROBE**

**INSTRUMENT CORPORATION**  
630 MERRICK ROAD, LYNBROOK, NEW YORK  
IN CANADA: ATLAS RADIO CORP., 50 WINGOLD AVE., TORONTO





Stellite faced exhaust valves and valve seats. One of the toughest alloys known. Give up to 300% longer valve life than ordinary valves. It's the important details like these that make Onan more economical in the long run.



# Picture of a man who bought a bargain" electric plant

If you want an electric plant for use a few hours a year on an annual camping trip, rent one. Or buy a "bargain." While it is true you get what you pay for, there's no need to pay for more machine than you can use.

But for high-use, professional applications, you need more brawn and stamina. The lightweight piece of equipment just won't deliver full-rated power consistently, won't stand up under heavy use. They're just not built that way.

When you need a workhorse, buy a piece of quality equipment. It'll pay off in the long run . . . often in a matter of weeks or months.

Onan Electric Plants are designed and built for high-use applications. We assume the use is going to be hard and heavy. That's why we use Stellite valves as standard equipment, where others make it an optional "adder" or can't supply. That's why Onan crankshafts are stronger, connecting rods and bearings bigger.

New Onan "J" Electric Plants have overhead valve design. No other engines in the 6 to 40 horsepower range are OHV. It's the first medium horsepower engine with this big engine feature. What's in it for you? *15% more power with 10% less fuel. Twice as much mileage before lead deposits build up as conventional L head engines.*

Next time you're in the market for an electric plant, estimate *how many hours* a year, *how many years* you expect to use it. The Performance Certified Onan will be your best buy by far. Simple arithmetic will prove it. Call your local Onan distributor. He's in the Yellow Pages, Thomas' Register, Sweet's.

**ONAN** Division, Studebaker-Packard Corporation • 2570 University Ave., Minneapolis 14

Onan's exclusive Magneciter generator is static excited to eliminate rotating exciter and mechanical regulator. Moving parts are eliminated in both exciter and regulator. Voltage recovery is five times faster than brushless type.



## PERFORMANCE CERTIFIED

We certify that when properly installed and operated this Onan electric plant will deliver the full power and the voltage and frequency regulation promised by its nameplate and published specifications. This plant has undergone several hours of running-in and testing under realistic load conditions, in accordance with procedures certified by an independent testing laboratory.



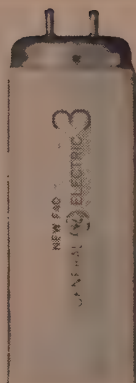




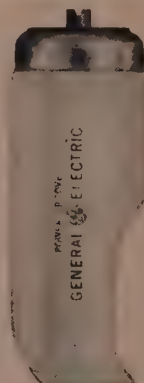
How a lamp buyer can tell the difference

**LET GENERAL ELECTRIC PROVE ITS EMPHASIS ON VALUE** and your customers will see why they get more for their dollar every time they buy a General Electric lamp. Every one of the fluorescent lamps you see on this page can make your customers more profit from light.

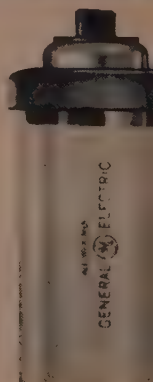
**THE NEW F40** gives your customers more light than any other standard forty-watt fluorescent on the market because inside it the Wattage Miser electrode converts formerly wasted watts to useful light.



**THE POWER GROOVE\*** is the most powerful fluorescent made; it puts more light on an area indoors or outside, cuts your customers' costs of installation by reducing the number of fixtures needed.



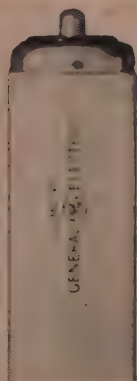
**THE ALL-WEATHER\*** is the glass-jacketed fluorescent designed by General Electric engineers for cold weather—it is the only fluorescent that maintains full light output without extra enclosure during zero temperatures.



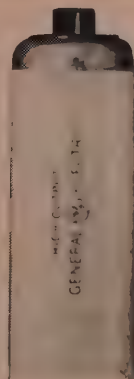




**GE SLIMLINE** is a lamp  
customers may already  
own—it is the most popular  
4-foot fluorescent—and  
light output and life  
ratings were both increased  
during the past year.



**THE HIGH OUTPUT** is  
a better buy than ever,  
because both its light out-  
put and life ratings were  
increased during the past  
year, another example of  
increasing values your cus-  
tomers get from G-E lamps.

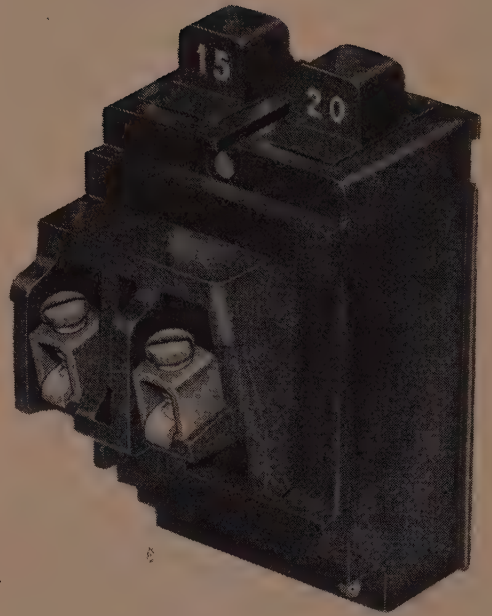
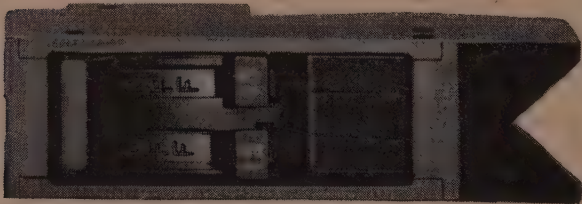


Your customers get extras because of the emphasis General Electric places on all kinds of values—from extra value lamps like those shown here, to extra help in using them, to extra availability through G-E supported stocks in every part of the nation. To learn about these values, call your General Electric office or write General Electric, Large Lamp Department C-250, Nela Park, Cleveland 12, Ohio.

\* Registered trademark of General Electric Co.

*Progress Is Our Most Important Product*  
**GENERAL  ELECTRIC**





*Why buy "married couples" when*





**you can have the better half?**

**12<sup>th</sup>**  
**Anniversary**  
**Stab-lok®**



PROGRESS  
WITHOUT  
OBSCURITY

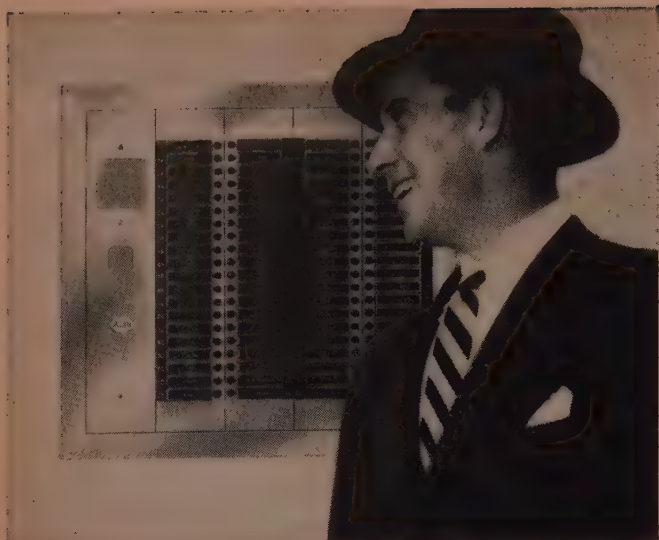
Twin...tandem...duplex—"togetherness" by any name cuts your operating flexibility by 66⅔%. Only Federal Pacific gives you complete flexibility with one-third the cost in the first and still exclusive half-module, single pole 15 and 20 amp Stab-lok® circuit breakers. Mix them or match them in any combination—15-15, 15-20, 20-15, 20-20. You'll find two "better halves" cut inventory and space costs of "married couple" breakers by two-thirds. Another demonstration of the "leader look" from the Company that is celebrating ten consecutive years of continuing leadership in the industry. Ask for Bulletin FPB-1-1000. Federal Pacific Electric Co., Newark 1, N. J.

FEDERAL PACIFIC ELECTRIC COMPANY

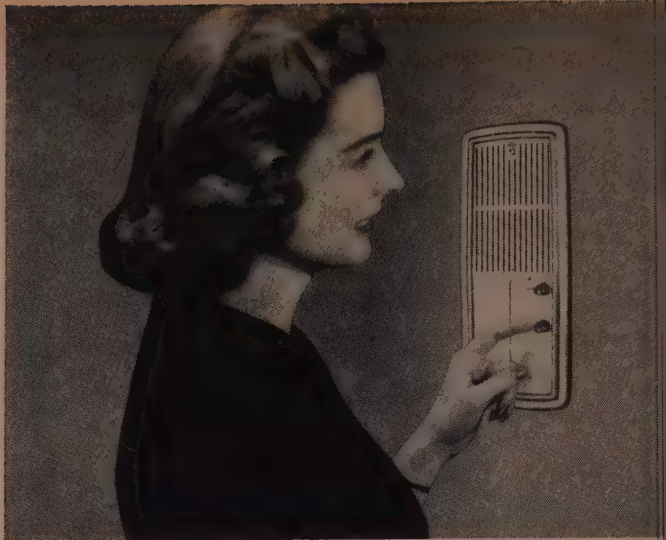


*growth through creative energy*

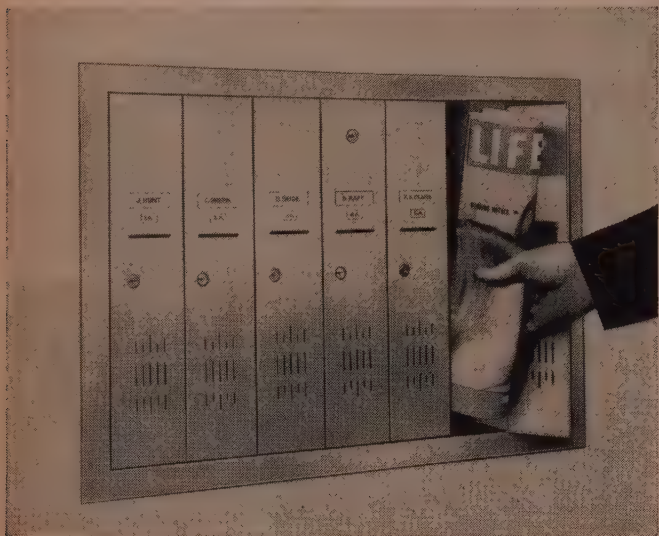




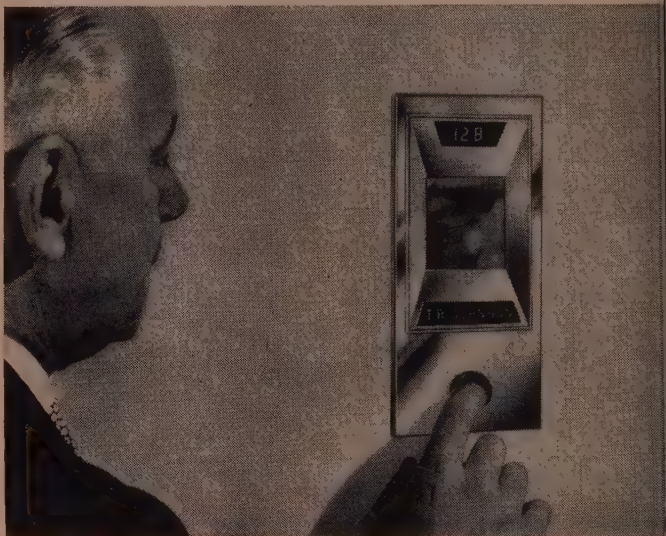
**VESTIBULE AND LOBBY TELEPHONES**, for communication with apartments, may be combined with mail boxes and alphabetical directories. New, modular design, cordless loudspeaking.



**APARTMENT TELEPHONES**, with new electronically-produced signals, are modern and streamlined. Simple, plug-in construction reduces installation costs, facilitates maintenance.



**"LIFE"-SIZE MAIL BOXES** do not bend or tear full size magazines or other mail because of the full-opening door design. Two-piece construction cuts down installation time, simplifies maintenance.



**NON-ELECTRIC DOOR CHIMES** are completely mechanical and provide lowest cost installation. Models available are: colonial knocker, pushbutton, one-way mirror viewer (illustrated).

## Only Auth Offers A Complete Line of APARTMENT HOUSE COMMUNICATION EQUIPMENT

More and more architects, contractors and distributors are calling on Auth for apartment house equipment. The reasons? Auth offers the widest selection of apartment house telephone systems, mail boxes and non-electric door chimes available anywhere in the country. This means you can meet all your requirements from one dependable source. And—no matter how extensive or complex the installation, you're assured of identical high quality and

efficiency throughout the building.

Most important for cost-conscious builders and contractors, Auth's 70 years of experience in manufacturing communication equipment for apartment house service means that every Auth product is engineered for easy, low cost installation, and minimum maintenance.

Auth "Life"-Size Mail Boxes, Vestibule-to-Apartment Telephone Systems, and Non-Electric Door Chimes pic-

tured above are typical of the quality equipment supplied by Auth for thousands of modern apartment buildings. Many other types and models are included in the Auth catalog to meet virtually every apartment house requirement.

If you are not yet acquainted with Auth apartment house equipment, write for new Auth Catalog Section AM today. A copy is yours for the asking without obligation.

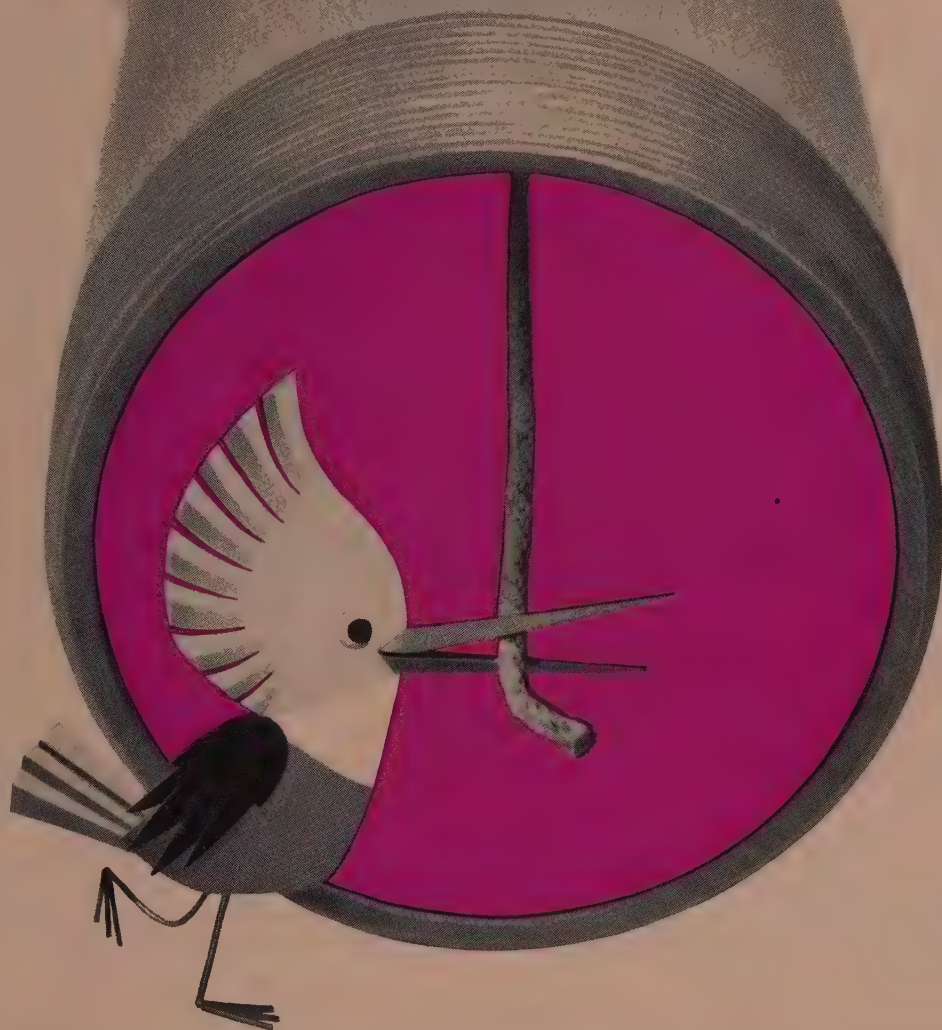


**Auth Electric Company, Inc.**  
LONG ISLAND CITY 1, NEW YORK

MANUFACTURERS OF APARTMENT HOUSE TELEPHONE SYSTEMS, MAIL BOXES, DOOR CHIMES, AND BELL SYSTEMS



●●●● KAISER ●●●●  
**KINGFISHER\***  
 ALUMINUM CONDUIT  
 ●●●●●●●●●●●●●●●●●●●●



## LOOK FOR THE PURPLE LINING THAT MAKES CABLE PULLS 61% EASIER

In tests† comparing lined and unlined conduits (including steel) the purple silicone lining in Kaiser KINGFISHER let cables slip past the third bend up to 36% easier . . . past the fourth bend up to 61% easier.

Kaiser KINGFISHER gives you four more time saving differences: light weight, easy cutting, uniform bending, and exclusive high strength forged couplings.

Only competitively priced Kaiser KINGFISHER has all the advantages of aluminum plus slick K-40 silicone lining. Cut installation costs on your jobs: look for the purple lining that makes cable pulls easier . . . from your authorized Kaiser KINGFISHER Distributor.

† Using 3 #2RHW cables in 1½" conduit.

\* Trademark of Kaiser Aluminum & Chemical Corporation.







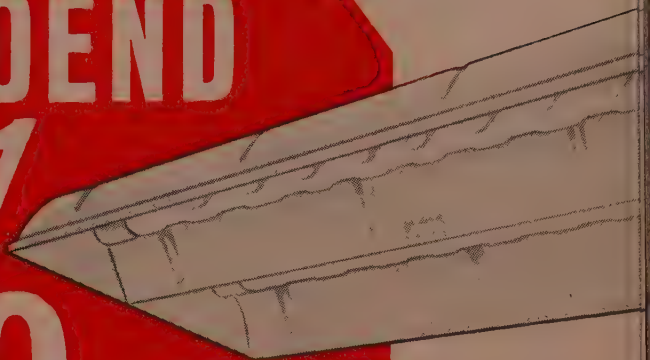
EFFECTIVE IMMEDIATELY

**DOUBLE DIVIDEND**

**10%**

**DISCOUNT**

on Day-Brite CFI-25<sup>®</sup>\*  
industrial fixtures



**Now.**

**1**

### **LOWER INITIAL COST**

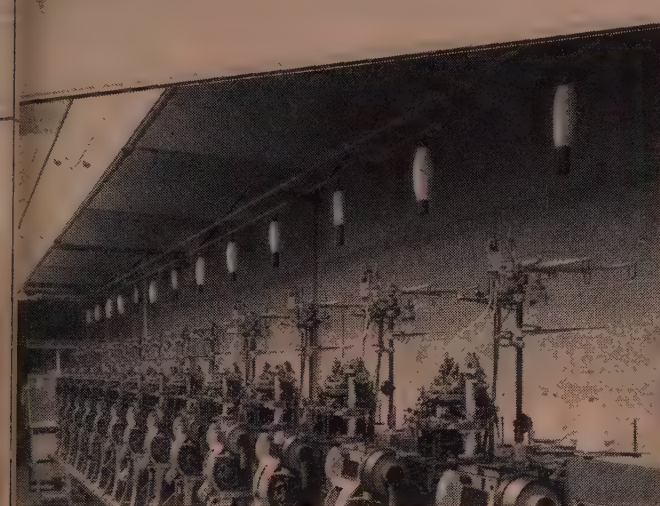
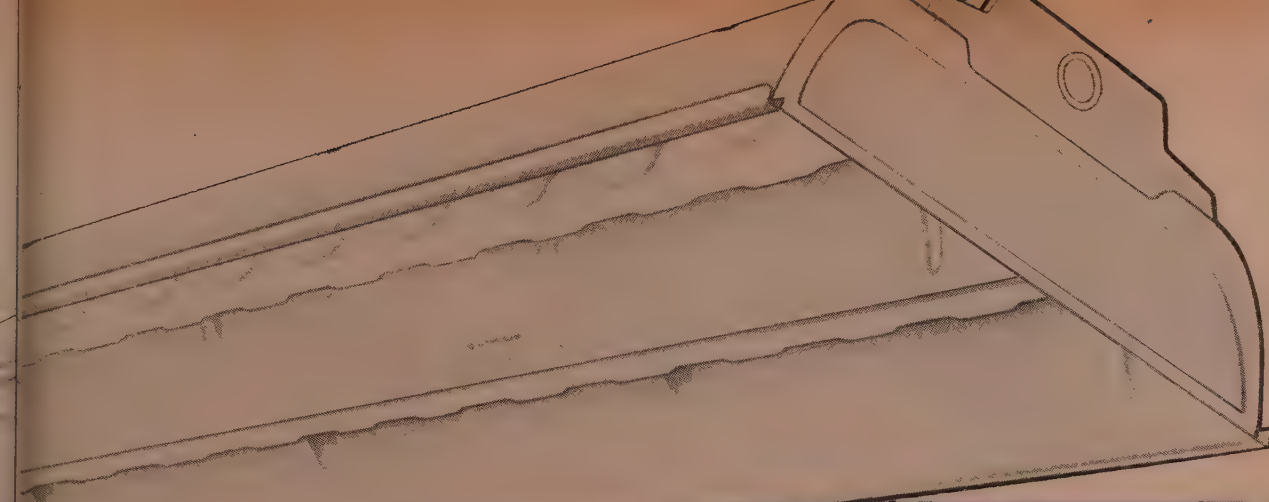
Save 10% on top quality Day-Brite industrial fixtures. They actually cost less than outdated solid top and 10% uplight equipment.

**2**

### **LOWER MAINTENANCE**

One-piece, 8-foot life-time porcelain reflector dramatically reduces cleaning time. Updraft air action provides efficient self-cleaning; light output stays up with fewer cleanings.





more production in the case of Charmeuse Co., Asheboro, N. C., with 30% fewer rejects.



10% more production for B. B. Walker Shoe Co., Asheboro, N. C., when just 3% would have covered the cost of the entire Day-Brite installation.

# You get famous Day-Brite quality at substantially lower cost

You are building a new plant or relighting an existing one, now there's no reason to settle for anything less than genuine Day-Brite "Comfort For Industry" lighting. Here's why:

**There is no change in the fixture quality performance,** yet you save on initial cost. In 1954, CFI-25 was reduced in price up to 17.7%. Increased production efficiencies make this additional saving possible. With this new 10% cost cut, these fixtures are now priced *below* much inferior industrial lighting equipment.

**You save on installation.** Day-Brite designs and builds these fixtures to go up fast, line up easily in 8-foot rigid channel, one-piece reflector.

**You save on increased production.** The same workers with the *same* tools in the *same* floor will produce *more* with Day-Brite CFI lighting.

And today, at the new lower cost, Day-Brite CFI lighting is an even better investment than ever before.

Get the whole story. Call your Day-Brite representative for the *facts* and the *fixtures*...or mail coupon.



AN EMERSON ELECTRIC COMPANY

**DAY-BRITE LIGHTING, INC.**

St. Louis, Mo., Tupelo, Miss., and Santa Clara, Calif.  
Amalgamated Electric Corp., Ltd., Toronto 6, Ont.

**NATION'S LARGEST MANUFACTURER  
OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT**

D-481

Day-Brite Lighting, Inc.  
6260 N. Broadway  
St. Louis 15, Mo.

Dept. EMC

Gentlemen: Send full information about Day-Brite CFI "Comfort For Industry" lighting fixtures.

NAME \_\_\_\_\_ TITLE \_\_\_\_\_

FIRM \_\_\_\_\_

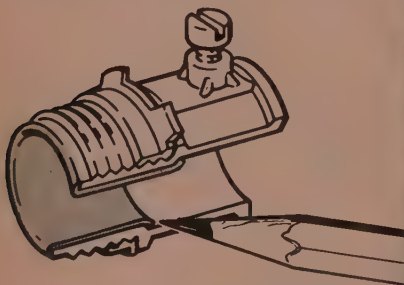
ADDRESS \_\_\_\_\_



# NEW FROM RACO



**RACO E.M.T. Pressure Cast Set Screw Fittings with Staked Screws.** These rugged new fittings have staked screws that are flush with the inside. You never have to back off screws and the screws never fall out. Designed of top quality alloy. Concrete tight. Deep cut threads speed up installation. Connector and coupling available in five sizes  $\frac{1}{2}$ " to 2".  
UL Approved

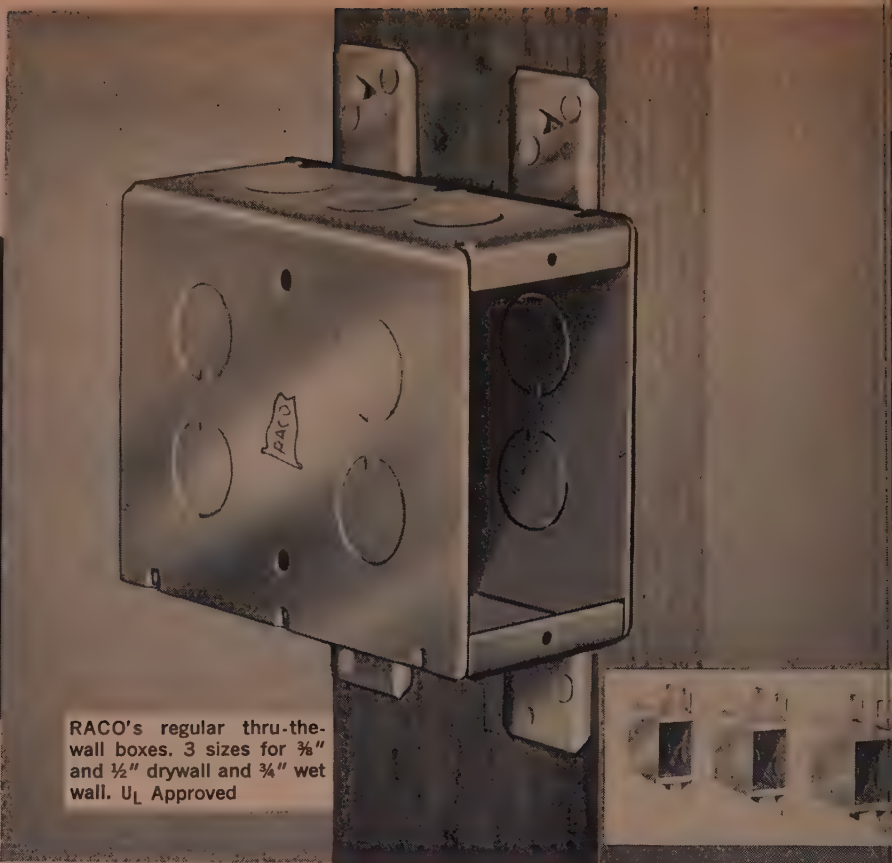


**E.M.T. Insulated Throat Set Screw Connector.** Cutaway above shows how RACO has rolled the insulated throat over the shoulder. This feature prevents throat from falling out, even with temperature changes. Eliminates the need for a separate plastic bushing. Available in six sizes  $\frac{1}{2}$ " to 2".  
UL Approved



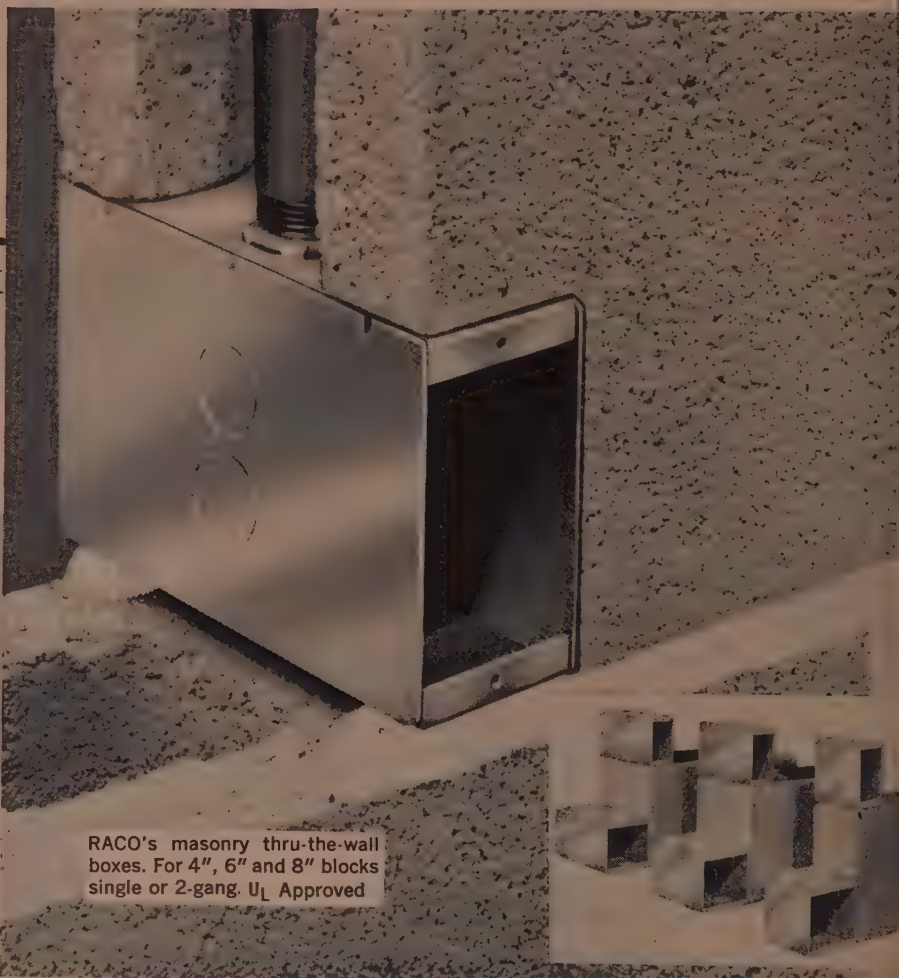
## FITTINGS For Every Need

- Rigid Conduit
- E.M.T. (Thinwall Conduit)
- Armored bushed cable, flexible metallic tubing and non-metallic cable
- Service entrances



RACO's regular thru-the-wall boxes. 3 sizes for  $\frac{3}{8}$ " and  $\frac{1}{2}$ " drywall and  $\frac{3}{4}$ " wet wall. UL Approved

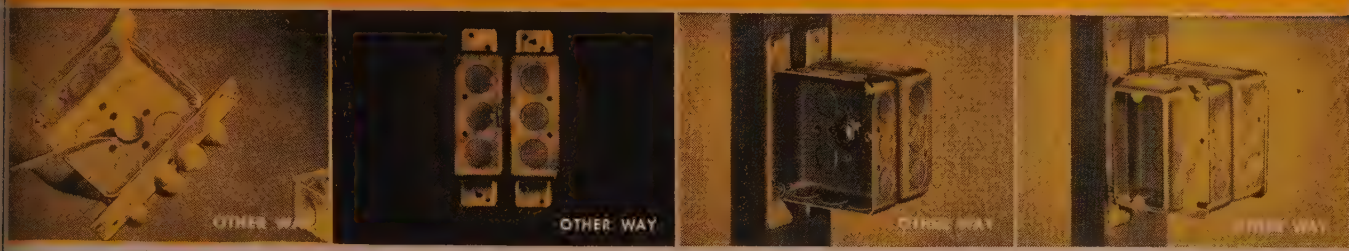
## Cut Costs with



RACO's masonry thru-the-wall boxes. For 4", 6" and 8" blocks single or 2-gang. UL Approved



# REGULAR CONSTRUCTION **SAVE 50%**



**Above:** Remove KO's on both 4" square boxes.

**Above:** Nipple two 4" boxes together, screw locknut on nipple and tighten.

**Above:** Nail two 4" boxes to studding.

**Above:** Two 4" square covers put in place.

**Below:** Nothing to remove thus saving you installation time.

**Below:** No nipping and no locknut required. RACO saves you material and time.

**Below:** One RACO thru-the-wall box, with mounting bracket can be nailed to the stud quickly and easily.

**Below:** No covers needed, thus ... eliminating a costly operation.



**OPERATION ELIMINATED**

**OPERATION ELIMINATED**

**OPERATION ELIMINATED**

**OPERATION ELIMINATED**

# RACO Thru-the-Wall Boxes

## MASONRY CONSTRUCTION **SAVE 38%**



**Above:** An oversized irregular area must be cut in the block for two 4" boxes.

**Above:** Remove KO's from two 4" boxes.

**Above:** Nipple two 4" boxes together, screw locknut on nipple and tighten.

**Above:** Two plaster covers installed on boxes.

**Above:** Mudding around is a messy, time consuming job. Holes have to be retapped.

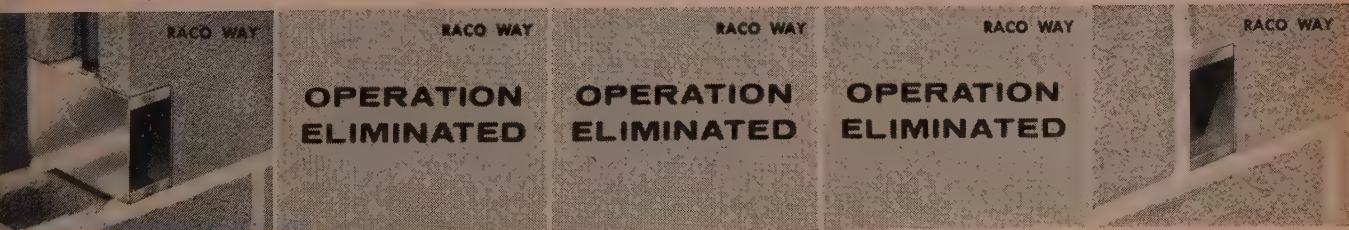
**Below:** Fitting square cornered RACO boxes require less work.

**Below:** Nothing to remove saving you time on-the-job.

**Below:** No nipping required eliminating costly labor and material.

**Below:** No covers needed on RACO thru-the-wall boxes.

**Below:** RACO boxes give you a neater, faster job. Device holes are inside ... no retapping.



**OPERATION ELIMINATED**

**OPERATION ELIMINATED**

**OPERATION ELIMINATED**

**OPERATION ELIMINATED**



**ALL-STEEL EQUIPMENT INC. Aurora, Illinois**





BEFORE YOU INSTALL ANOTHER MOTOR STARTER,  
MEASURE ITS TOTAL VALUE

## Compact size is important, but what other factors should you consider in making your choice?

**I**mportant to have a compact starter when space is at a premium? You said it! And, you wouldn't even consider a motor starter that won't deliver dependable performance, easy maintenance, long contact life, and quick installation. They're all quality standards in which Cutler-Hammer starters have long excelled.

But, there's more to consider when selecting a motor starter. Hundreds of contractors have told us they often choose Cutler-Hammer starters because of certain *non-product* factors which combine to give total value every time:

**"OFF-THE-SHELF" AVAILABILITY.** Over 91% of your standard starter needs are available from local stocks. Even very special requirements can often be handled overnight. With Cutler-Hammer, complete starters or replacement parts are a phone call away . . . from the balanced stocks of more than 600 Distributors backed by 66 district offices and 17 regional warehouses.

**COMPLETE SERVICE.** Both your Distributor and your Cutler-Hammer man treat your application problems as their own. Together they are equipped to handle your special requirements—and emergencies—in just a matter of hours.

**FULL PRODUCT LINE.** Cutler-Hammer offers you a complete line of ten NEMA sizes . . . 00 through 8. The entire starter line is designed to rugged industrial standards . . . is proven in hosts of applications . . . and exceeds NEMA requirements in every respect.

So, next time you're contemplating a motor starter, don't stop short with an evaluation of product factors only. Also measure the non-product values you get with Cutler-Hammer's immediate availability, complete service, and a full product line. For complete details, send for bulletin LO-70-S241. And for Cutler-Hammer's *total-value* story, call your local Cutler-Hammer Distributor today!

WHAT'S NEW? ASK...

# CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Divisions: AIL; Mullenbach • Subsidiaries: Uni-Bus, Inc.; Cutler-Hammer International, C.A. • Associates: Cutler-Hammer Canada, Ltd.; Cutler-Hammer Mexicana, S.A.





**EXTEND ANY PRESENT BUSDUCT SYSTEM TO ANY PLANT AREA FOR LESS THAN WIRE & CABLE COST!**

**FRANK ADAM**

*Power  
Plug in*

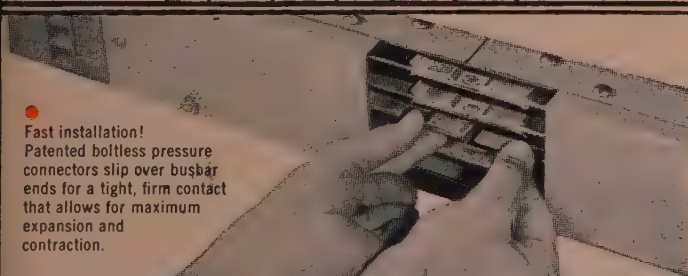
**MIDGET  
BUSDUCT**



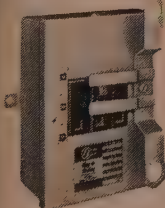
● Midget Busduct delivers instant power for equipment as easily as plugging in an extension cord.



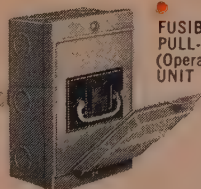
● Fast installation! Patented boltless pressure connectors slip over busbar ends for a tight, firm contact that allows for maximum expansion and contraction.



● **CIRCUIT  
BREAKER  
PLUG-IN  
UNIT**



● **FUSIBLE  
PULL-OUT  
(Operating)  
UNIT**



● **FUSIBLE  
PLUG-IN  
(Non-operating)  
UNIT**



**Instant 100-Amp. Plug-In Power When And Where It's Needed With MIDGET BUSDUCT**

Although the initial price of Midget Busduct is slightly more than wire and cable, the saving on labor alone results in a surprisingly lower installed cost.

No cutting or bending, no threading of conduit is necessary with Midget Busduct. It is 100% salvable when plant layouts are changed, or machine relocations are made. Quick availability of plug-in units permits load connections in minutes to save even more on labor.

Either copper or aluminum conductors can be furnished. Midget Busduct has plug-in outlets every 12", on one or both sides, to accommodate several types of plug-in units, (three are shown at left), in 30 to 100 amp. capacity. Ask for complete information and prices.



**FRANK  
ADAM ELECTRIC COMPANY**  
P. O. BOX 357, MAIN P. O. • ST. LOUIS 66, MO

SINCE 1891

busduct • panelboards • switchboards • service equipment  
safety switches • load centers • Quikheter





## RENEWAL PARTS DIVISION

Clancy Atkins is up to here

in replacement parts



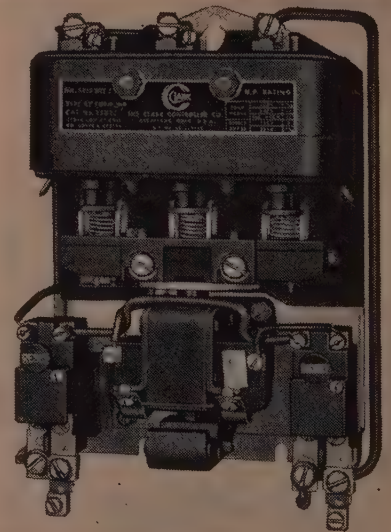
Clark customers, happily, haven't much need for Clancy Atkins' services—he's our replacement parts manager.

To while away his time, Clancy keeps a fine set of records. Example: During the past seven years, Clancy has shipped only one set of replacement contacts for every 23 Clark CY size 1 starters sold.

Such reliability may be a problem for Clancy, but it can mean big value to you—when productivity of men, machines and materials depends upon consistent performance, repeated millions of times, by vital electrical controls.

Compare all makes with Clark when you buy or replace electrical controls. Compare for quality construction, ease of installation and long service reputation.

And, compare price. Clark controls cost no more.



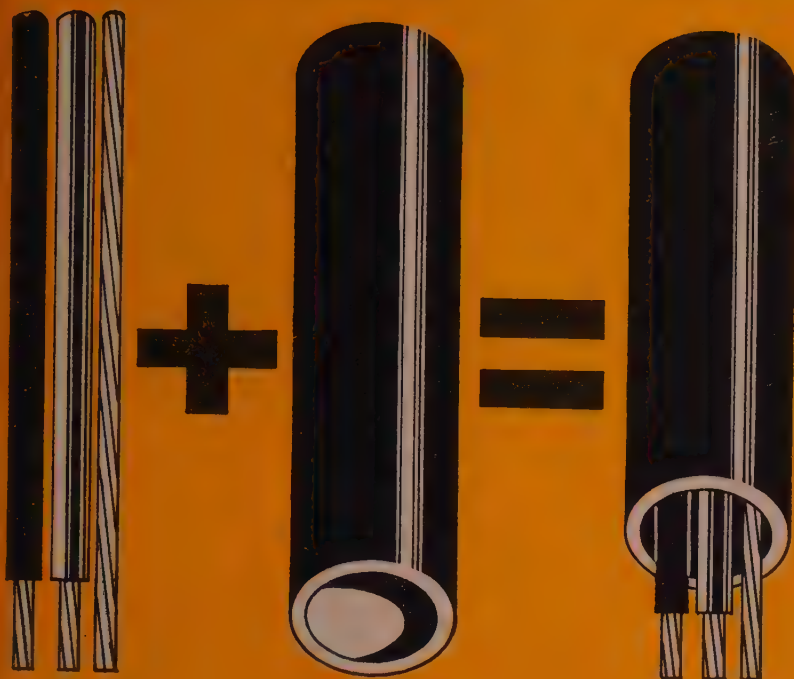
**90 WAYS NEWER!** Clark's CY starter line retains its basic time-proven design, but improvements to increase operating efficiency are being made constantly. On this size 2 starter, for example, 90 separate improvements have been made since 1950. The starters we make today may put Clancy out of business entirely.

**THE CLARK CONTROLLER COMPANY**

MAIN PLANT: CLEVELAND, 10 • WESTERN PLANT: LOS ANGELES, 58  
IN CANADA: CANADIAN CONTROLLERS, LIMITED, TORONTO, ONT



# TRIANGLE UNIT TYPE DUCT-CABLE SYSTEM



**A COMPLETE,  
PRE-ASSEMBLED  
UNDERGROUND STREET  
LIGHTING CIRCUIT...  
ALREADY ENCLOSED  
IN PLASTIC DUCT!**

**BIG SAVINGS IN TRANSPORTATION... TRENCHING... INSTALLATION**

Triangle's Unit Type Duct-Cable System\* has been designed and engineered to overcome the disadvantages of the installation of duct in short lengths with sleeve type couplings. Triangle's method provides a vastly superior system at considerably lower cost through the use of a "UNIT ASSEMBLY" consisting of the required number of parallel conductors in long length coilable plastic duct on reels.

- **Easier To Transport**—No separate units to be transported and assembled but a complete system, ready for installation.
- **Easier To Trench**—There's no need to work in the trench, therefore only a small slot trench is required. Or, just plow the system in.
- **Easier To Install**—Duct need not be straightened too much, since some snaking is necessary to accommodate expansion and contraction. This system eliminates use of fish wire, splice boxes and fittings to meet changes in route and profile. Eliminates the necessity for sand bedding, protective planking or other precautions normally required for direct burial cable.
- **High Impact Strength**—Withstands heavy pounding of overhead traffic, severe abuse by hand tools such as shovels and picks.



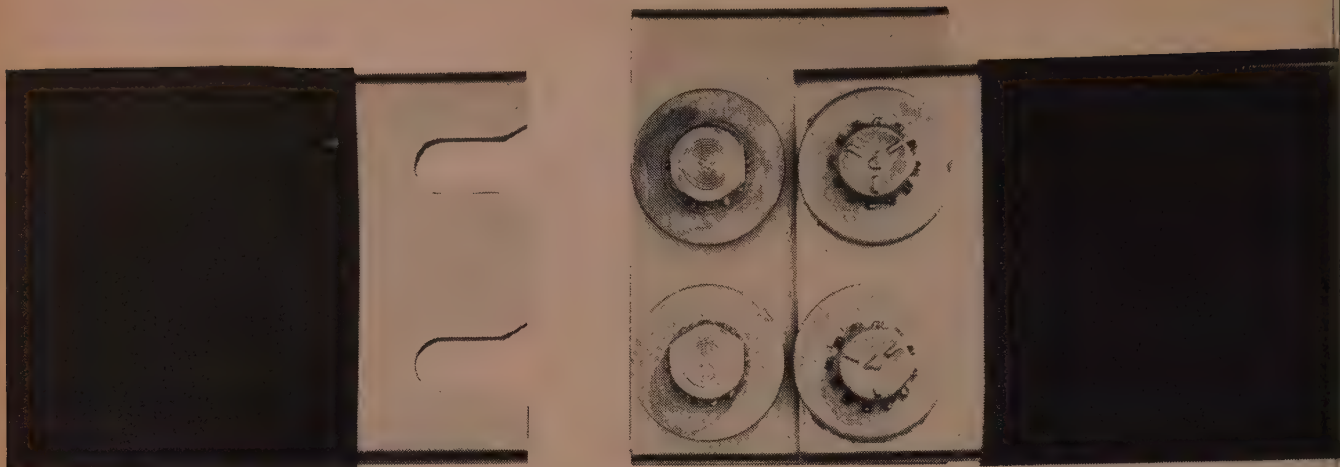
\* Patent applied for

For complete Technical information on the  
Triangle Unit Type Duct-Cable System, write:

WIRE AND CABLE DIVISION  
**TRIANGLE CONDUIT & CABLE CO., INC.**  
NEW BRUNSWICK, NEW JERSEY  
  
"It MUST Be Right!"



**just slip in place**



**and tighten bolts**



## **Westinghouse Plug-In Low Impedance Bus Duct cuts installation costs**

Exclusive Westinghouse factory-installed captive hardware eliminates the time-consuming alignment of joints; threading and fastening of loose hardware. Just slip together and tighten from either side for a high strength, low power loss connection. Its lighter weight and small size (up to 33% smaller than other makes) contribute to easier handling especially on limited-space jobs. In one actual installation, studied by S. M. Dix and Associates of Grand Rapids, Michigan, two men installed a complete section of Westinghouse duct in less than eight minutes! Installed cost is the important cost, and no other plug-in low impedance bus duct can be installed faster than Westinghouse.

In ratings of 600 to 4000 amperes, this duct is available with copper or aluminum conductors and a complete line of fittings, hangers, and plug-in units. For further information contact your Westinghouse representative; or write, Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa. *You can be sure . . . if it's Westinghouse.*

J-30340

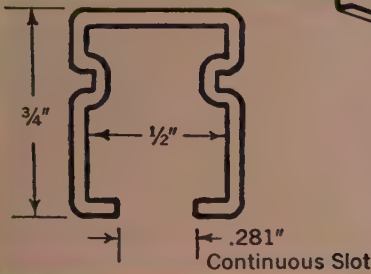
**Westinghouse**





# NEW ALL-PURPOSE CHANNEL BARS

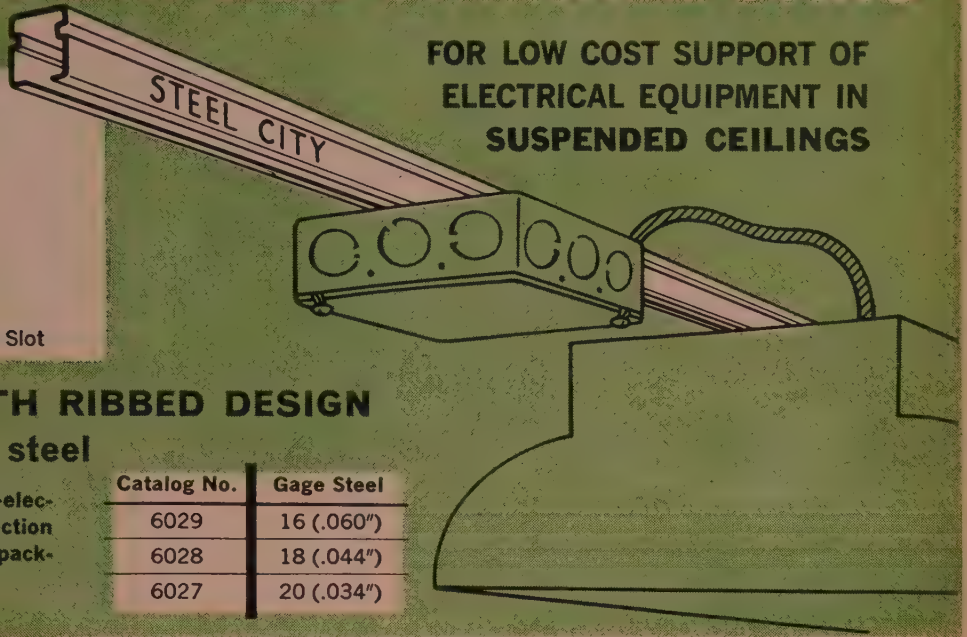
FOR LOW COST SUPPORT OF  
ELECTRICAL EQUIPMENT IN  
SUSPENDED CEILINGS



## EXTRA-STRENGTH RIBBED DESIGN Made in 3 gages of steel

Extra bright Galv-Krom Finish—electrogalvanized, PLUS added protection of zinc chromate. 10 ft. lengths packaged 100 ft.

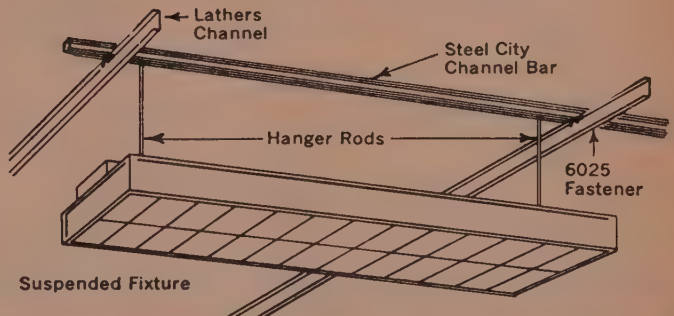
| Catalog No. | Gage Steel |
|-------------|------------|
| 6029        | 16 (.060") |
| 6028        | 18 (.044") |
| 6027        | 20 (.034") |



## Simplifies locating and mounting of fixtures, conduits and boxes

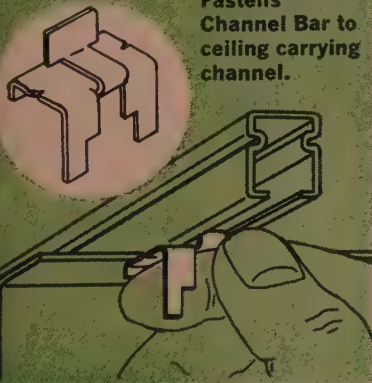
Here's a new series of Channel Bars to simplify the support of overhead fixtures, conduits and boxes in suspended ceiling construction. The handy Channel Bars, installed slot-side down, provide unlimited positioning of electrical equipment or continuous line of support for lighting fixture hangers. Channel Bars are fabricated from three separate gages of steel for a wide range of applications and minimum load-bearing deflection values. You'll like Channel Bar adaptability and low cost usefulness. Steel City Channel Bars are available now for your next suspended ceiling job. Bulletin 62-1 features load deflection charts.

### For Surface or Suspended Luminaires

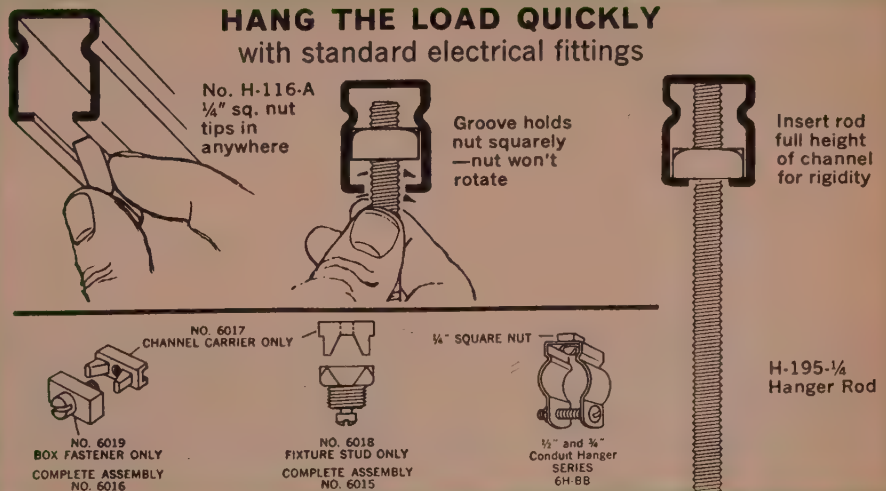


### NEW CHANNEL BAR FASTENER

No. 6025  
Fastens  
Channel Bar to  
ceiling carrying  
channel.



### HANG THE LOAD QUICKLY with standard electrical fittings



Write for Samples and Product Bulletin 62-1



**Steel City**  
PITTSBURGH 33, PA.

STEEL CITY ELECTRIC CO. — A CONSTRUCTION MATERIALS DIVISION OF **MARTIN MARIETTA**





**1**

### UNI-BUS DUCT

Plug-in convenience... any

**2**

### UNI-BUS PLUG-IN DEVICE

Use anywhere; completely

**3**

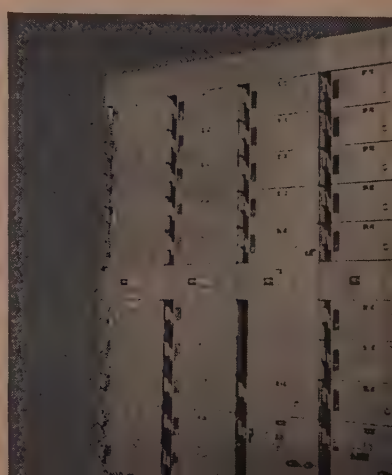
### UNI-BUS PLUG-IN CENTER

Replace panelboards with p  
convenience and safety!

**1. HALF THE WEIGHT** of most other ducts; selective low voltage drop; easier installation; easier maintenance... yet Uni-Bus costs no more! Family of six types for all industrial, commercial, laboratory and high rise building needs. Rated 100-4000 amps., 600 volts.

**2. COMPLETE SAFETY, COMPLETE CONVENIENCE** with Uni-Bus Plug-in devices which provide branch circuits at every 10 inches of Uni-Bus duct... or in stacks in the new Uni-Bus plug-in distribution centers. Patented interlocks make it impossible to touch a live part!

**3. PLUG-IN POWER** for distributed motor control, and lighting panels is provided by new, flexible Uni-Bus Plug-in centers. Plug-in Trof design takes 3 less space; provides groupings of 2 to 4 locked plug-in outlets in 20 inch wide enclosures.







*A new approach to in-plant power*

# Uni-Bus makes your entire distribution system a plug-in switchboard!

*Get low voltage drop, easy installation, the ultimate in flexibility, safety and power availability...yet you pay no more!*

**H**ere's an entirely new kind of distribution system that provides all you need in accessible and flexible circuit protection right from the main disconnect to the ultimate use!

It's so safe you can't touch a live part anywhere in the system . . . so convenient you can plug in any place, any time . . . so lightweight and easy to assemble you can cut installation and maintenance time drastically.

That's not all! Better design gives better electrical performance . . . low voltage drop; no derating regardless of mounting plane.

Uni-Bus is so flexible you can revise it readily even if your plant layout changes every year. No obsolescence . . . duct, plug-ins and fittings are 100% reuseable.

Look at this list of Uni-Bus features. Don't you see a *better* answer to *your* power distribution problems?

**Standard Components**—Uni-Bus is a complete system featuring interchangeable parts all the way. Uni-Bus requires less than  $\frac{1}{4}$  of the accessories of ordinary busway.

**No Specials**—Off-the-shelf lengths mean you can tailor straight runs within  $2\frac{1}{2}$ ". Exclusive

flexible connectors take care of special turns and offsets.

**Low Impedance**—Ratings are increased through use of multiple bars scientifically spaced . . . specially insulated aluminum and copper bus bars are supported and air spaced by durable polyester glass insulators in ventilated steel enclosures.

**Easy to work on**—Complete safety not only protects life but also means worry-free, quicker work with less downtime for maintenance or alterations.

**A system that grows**—Plug-in centers grow with your needs. Plug in another standard device . . . or add another standard plug-in. No need to wait while somebody assembles and wires a new panelboard.

Next time you build, remodel, or expand a plant get the busway system that gives you so much more. Choose Uni-Bus . . . the complete power distribution system with complete plug-in safety, convenience, and economy.

See your Cutler-Hammer distributor or representative today! Or write direct for Publ. LU-23-T241 on Uni-Bus duct systems and plug-in distribution centers.

WHAT'S NEW? ASK...

## CUTLER-HAMMER

Cutler-Hammer, Inc., Milwaukee, Wisconsin • Divisions: AIL; Mullenbach • Subsidiaries: Uni-Bus, Inc., Cutler-Hammer International, C.A. • Associates: Cutler-Hammer, Canada, Ltd.; Cutler-Hammer, Mexicana, S.A.





EXCLUSIVE...FROM JOHNS-MANVILLE!



## Designed to work at low temperatures, J-M Dutch Brand® Cold Weather Tape handles easily...conforms readily!

Here is the tape-and-dispenser combination that gives top performance at regular or sub-zero temperatures. It is J-M Dutch Brand® No. 167-D Plastic Electrical Tape.

Flexible and workable both Summer and Winter, because Johns-Manville uses a new vinyl backing with special, all-weather properties.

Assures moisture-free splices, because Johns-Manville has developed a new adhesive that defies wet weather.

Sticks instantly, because this new adhe-

sive was specially formulated for use over a wide range of temperatures encountered by electricians.

Tears instantly at low temperatures, because this special cold-weather plastic electrical tape comes in J-M's unique "tape-and-tear" dispenser tool that stays sharp... has no moving parts

to break... protects tape against dirt and grease.

Try J-M Dutch Brand No. 167-D Cold-Weather Plastic Electrical Tape for yourself. Dutch Brand Division, Johns-Manville, Box 359 New York 16, N. Y. In Canada: Port Credit, Ont. Cable: Johnmanvil.



JOHNS-MANVILLE  
DUTCH BRAND TAPE



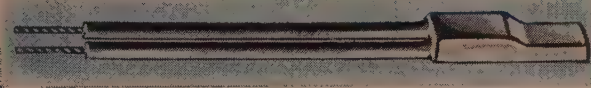


ADVAN-guard® is a thermally actuated automatic reclosing protective device sealed in the ballast housing. It is sensitive to voltage and current as well as temperature and protects against excessive voltage supply . . . internal ballast short circuiting . . . inadequate lamp maintenance . . . improper fixture application and eliminates the need for individual fixture fusing. ADVAN-guard® is preset to trip out automatically whenever the Fluorescent Lamp Ballast operates at abnormal temperatures. When heat decreases to normal operating temperatures, ADVAN-guard® resets automatically and the ballast resumes normal operation. Through this continuous protection the full life of ADVAN-guard® Fluorescent Lamp Ballasts is realized. Only ADVAN-guard® ends premature destruction and unnecessary replacement labor costs.

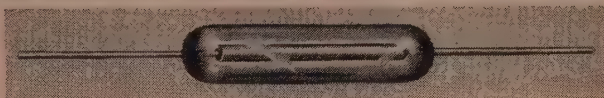
AUTOMATIC RE SETTING

**ADVAN**

THERMAL PROTECTION



## ADVANCE OFFERS A CHOICE OF BALLAST PROTECTION



EQUIPPED WITH

NON-RESET

**FUSE LINK**

THERMAL

PROTECTOR

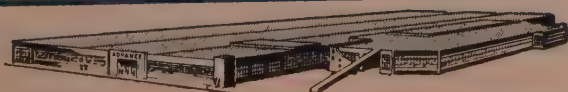
Advance FUSE-LINK is a temperature sensitive non-resetting protector built into the fluorescent lamp ballast. It is sensitive to heat and designed to open when the ballast is subjected to high temperature from any internal or external cause. The capacitor utilized in the FUSE-LINK ballast line also incorporates a thermal link which will open whenever the capacitor is subjected to abnormally high temperatures.

FUSE-LINK Fluorescent Lamp Ballasts protect against ballast leakage and end-of-life hazards. When a condition occurs that causes either or both links to open . . . the ballast is destroyed and must be replaced.

That's the protection story, ADVANCE offers a choice!

Your ADVANCE Sales Engineer will be happy to help you make that choice. Call him or write today.

*"The Heart of the Lighting Industry"*



**ADVANCE®**



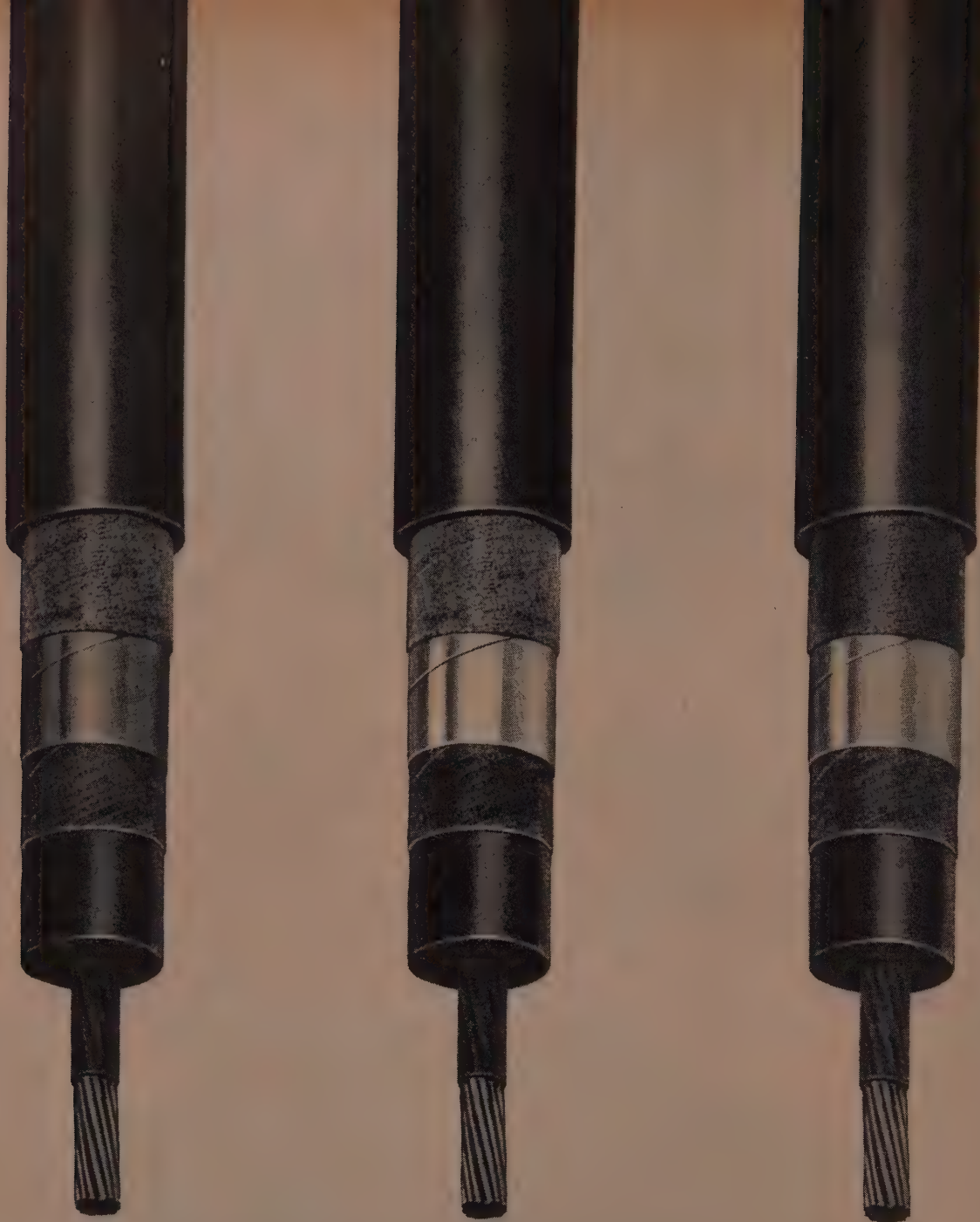
WORLD'S LARGEST EXCLUSIVE  
MANUFACTURER OF  
FLUORESCENT LAMP BALLASTS

2950 NO. WESTERN AVE. CHICAGO 18, ILL. U.S.A.



**TRANSFORMER CO.**





## *Which one is the Circle cable?*

**It's the one in the middle.** But, don't feel too badly if you guessed wrong. To the naked eye there is no apparent difference. Most power cables look alike. The big difference in Circle cable lies in the extra care taken in its manufacture...in the high quality of the materials of construction...and particularly in the stringent tests it undergoes to assure that it meets every rigid specification.

You'll notice the difference in the service you get from Circle power cable. On your next job be sure to specify Circle cable—there is no finer cable made.



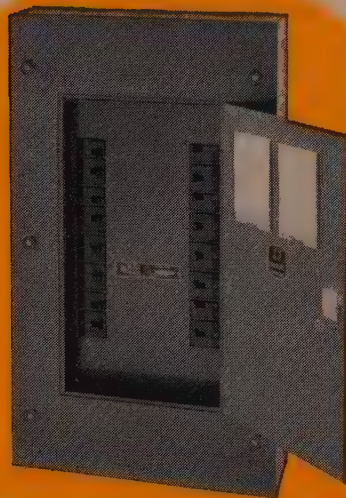
**CIRCLE WIRE & CABLE CORP.**

SUBSIDIARY OF CERRO CORPORATION

PLANTS: Maspeth and Hicksville, N. Y. SALES OFFICES & WAREHOUSES: In all principal cities.  
Rubber Covered Wires & Cables • Varnished Cambric Cables • Plastic Insulated Cables • Neoprene Sheathed Cables • "CIRTUBE" EMT



**Not a boast...  
but an acknowledgement of  
the obligation of leadership**



## **SQUARE D SELLS MORE PANELBOARDS THAN ANY OTHER MANUFACTURER**

• There are three reasons for Square D's predominance in the panelboard field...

First, the line is complete. Whether the requirement calls for AC or DC or both; lighting or power distribution or both; fusible or circuit breaker; plug-in or bolted construction; Square D has the right panelboard for practically any given job.

Even more important is the quality which

is built into every Square D panelboard—difficult to define but a very important combination of many details.

Availability is always an important factor—and here Square D rates especially high. Regional manufacturing and assembly facilities for "specials," combined with a national network of stocking distributors for standard panels, provide exceptional delivery and service.

**write for Bulletin SD-126. It tells the quality story in detail**

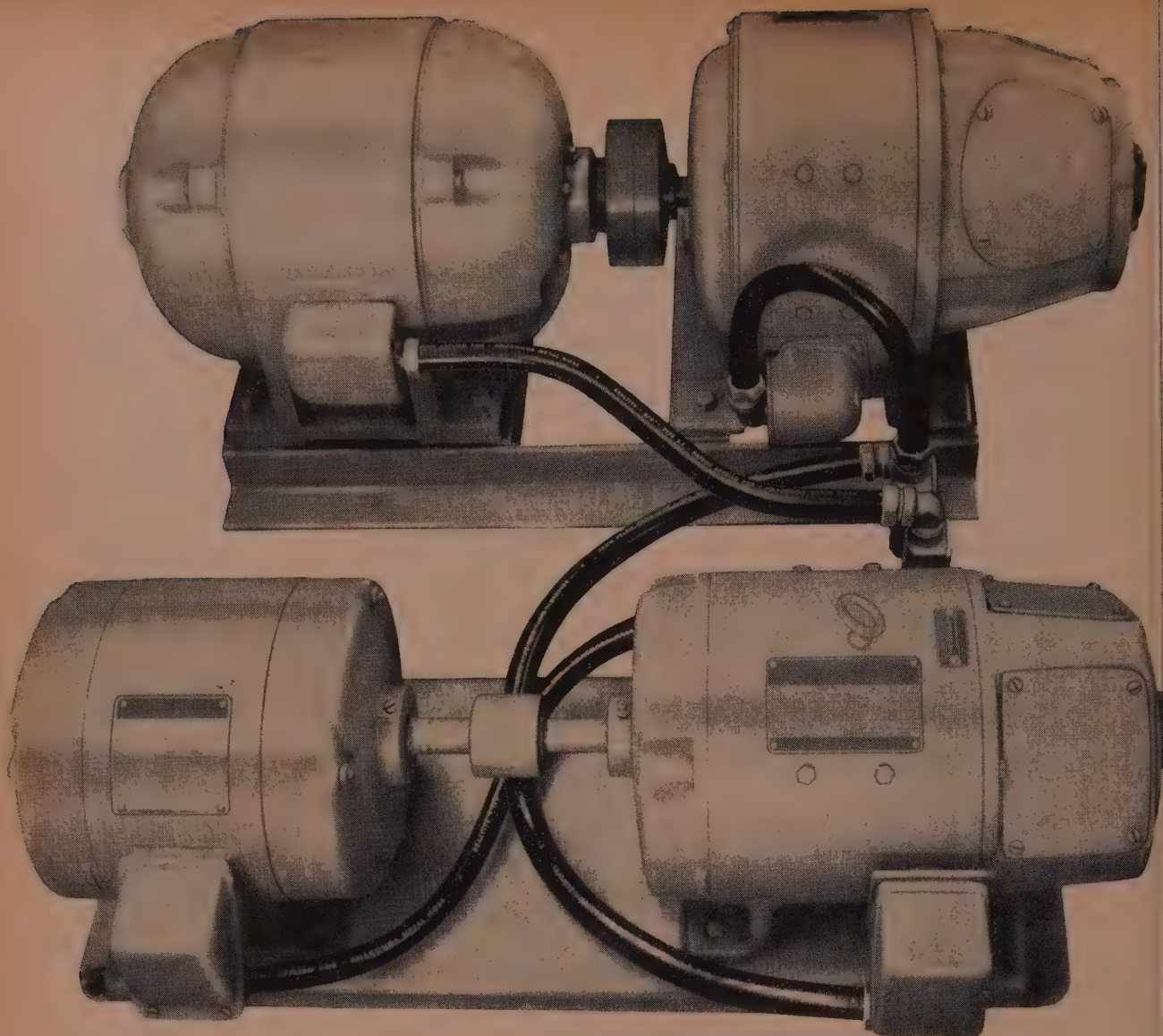
**Square D Company, Mercer Road, Lexington, Kentucky**



# **SQUARE D COMPANY**

*wherever electricity is distributed and controlled*





## why you should specify SEALTITE®

... the liquid-tight conduit that can take a tight turn

Why put up with the extra labor of bending and fitting rigid conduit? SEALTITE is easily installed . . . follows contours and connects outlets that do not line up.

Extremely durable, SEALTITE's tough polyvinyl chloride jacket over a flexible, galvanized steel core is unfazed by conditions that corrode ordinary conduit. Safety-seals all wiring against oil, grease, water, dirt, chemicals, corrosives, weather. Specify SEALTITE, the original . . . proved the best yet costs no more.

Get what you specify: The conduit you receive is Sealtite only when it's marked Sealtite and Anaconda on the cover. For Sealtite Bulletin S-544, write to: Anaconda Metal Hose Division, Anaconda American Brass Company, P.O. Box 791, Waterbury 20, Connecticut.

61-1911

### SPECIFICATIONS

|         | Trade Size (In.) | INSIDE DIAMETER |       | OUTSIDE DIAMETER |       | Approx. Inside Bend Diam. (Inches) | Feet Per Std. Coil | Approx. Shipping Wgt. (Lbs.) |               | Feet Per Std. Reel | Approx. Shipping Wgt. (Lbs.) |               |
|---------|------------------|-----------------|-------|------------------|-------|------------------------------------|--------------------|------------------------------|---------------|--------------------|------------------------------|---------------|
|         |                  | Min.            | Max.  | Min.             | Max.  |                                    |                    | Per Std. Coil                | Per Std. Reel |                    | Per Std. Reel                | Per Std. Reel |
| TYPE UA | 1/8              | .484            | .504  | .690             | .710  | 6                                  | 200                | 60                           | 1500          | 460                |                              |               |
|         | 1/2              | .622            | .642  | .820             | .840  | 7                                  | 200                | 70                           | 1000          | 365                |                              |               |
|         | 3/4              | .820            | .840  | 1.030            | 1.050 | 10                                 | 150                | 70                           | 850           | 420                |                              |               |
|         | 1                | 1.041           | 1.066 | 1.290            | 1.315 | 13                                 | 100                | 90                           | 600           | 525                |                              |               |
|         | 1 1/4            | 1.380           | 1.410 | 1.630            | 1.660 | 16                                 | 50                 | 70                           | 375           | 430                |                              |               |
|         | 1 1/2            | 1.485           | 1.505 | 1.690            | 1.710 | 4                                  | 250                | 60                           | 1500          | 390                |                              |               |
| TYPE EF | 1/2              | .620            | .640  | .820             | .840  | 5                                  | 200                | 60                           | 1000          | 325                |                              |               |
|         | 3/4              | .815            | .835  | 1.030            | 1.050 | 6                                  | 175                | 70                           | 850           | 375                |                              |               |
|         | 1                | 1.030           | 1.055 | 1.290            | 1.315 | 8                                  | 100                | 60                           | 600           | 420                |                              |               |
|         | 1 1/4            | 1.370           | 1.395 | 1.635            | 1.660 | 9                                  | 100                | 80                           | 375           | 360                |                              |               |
|         | 1 1/2            | 1.575           | 1.600 | 1.875            | 1.900 | 11                                 | 50                 | 55                           |               |                    |                              |               |
|         | 2                | 2.020           | 2.045 | 2.350            | 2.375 | 14                                 | 50                 | 75                           |               |                    |                              |               |
|         | 2 1/2            | 2.480           | 2.505 | 2.850            | 2.875 | 19                                 | 50                 | 105                          |               |                    |                              |               |
|         | 3                | 3.070           | 3.100 | 3.470            | 3.500 | 23                                 | 25                 | 80                           |               |                    |                              |               |
|         | 4                | 4.000           | 4.040 | 4.460            | 4.500 | 28                                 | 25                 | 105                          |               |                    |                              |               |

**ANACONDA®**  
METAL HOSE DIVISION

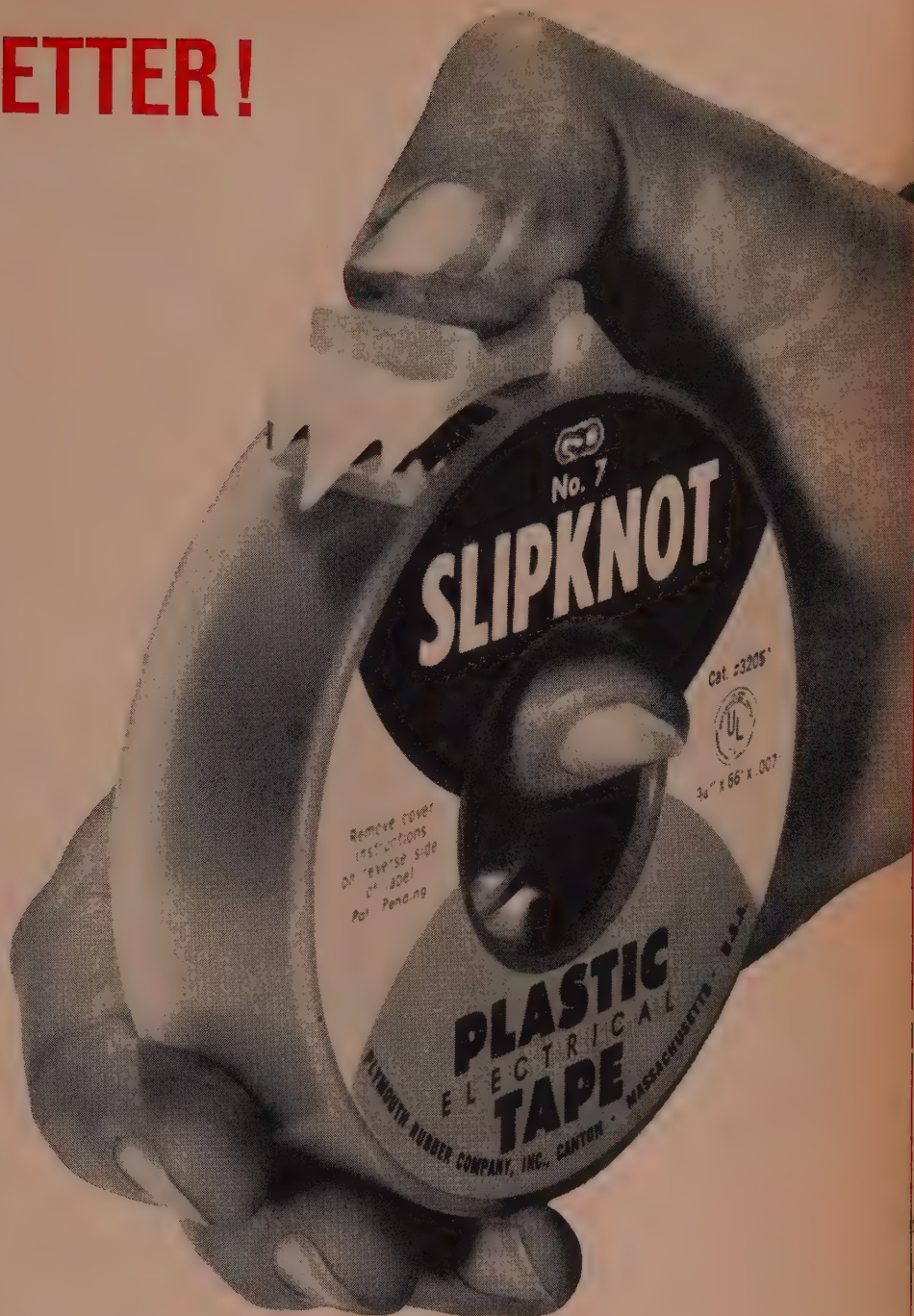


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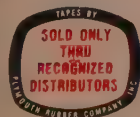
FLIP 'N CUT®, a Slipknot exclusive, speeds the job and saves you money. It's FREE with each 30' - 44' - 66' roll!



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**Makers of SLIPKNOT FRICTION TAPE — most widely used in the world**

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . SEPTEMBER, 1962







## Leave competition behind with Dodge Reports

Here's a tip for electrical contractors who want to get ahead in the scramble for new construction business. Dodge Reports can give you *advance* news—every day—on practically every new project you'd like to have. You concentrate your new-business efforts on jobs that look best to you—leave the rest to competitors who don't have this advantage.

It's easy—you tell Dodge just the type, size and location of jobs you'd be interested in; and that's just what Dodge sends you.

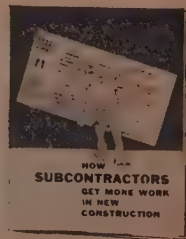
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Applications (10 to 75 hp)  
are Satisfied by Furnas  
Exclusive Sizes 1¼, 2½  
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Now you can match the starter to your exact horsepower requirement, eliminating wasted space and capacity (and cost). Only Furnas offers a really complete line of motor starters through Size 4. Our exclusive Sizes 1¼, 2½ and new 3½, all standard with Furnas, meet the horsepower/motor ratings between 10 and 75 hp that are not covered by the usual size starters. You'll find that Furnas horsepower rated starters do the job better, more economically.

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# WIREMOLD® ELECTRIC IDEAS

PREPARED EACH MONTH FOR ELECTRICAL CONSTRUCTION AND MAINTENANCE  
TO BRING IDEAS, NEWS AND HELPFUL INFORMATION TO ELECTRICAL MEN

63rd YEAR

SEPTEMBER, 1962

|                                          |                                         |                                       |
|------------------------------------------|-----------------------------------------|---------------------------------------|
| NEW WIRING IN OLD HOUSE ..... FIRST PAGE | PRODUCT OF THE MONTH ..... SECOND PAGE  | ENGINEERED SPECIALS ..... FOURTH PAGE |
| CODE COMMENTS ..... FIRST PAGE           | QUIZ CORNER ..... SECOND PAGE           | NOTEWORTHY ..... FOURTH PAGE          |
| EDITORIAL ..... SECOND PAGE              | COUPON FOR FREE ITEMS ..... SECOND PAGE | PRACTICAL TIPS ..... FOURTH PAGE      |



DRAMATIC MODERNIZATION of old home began with installation of new wiring and multi-outlet systems. Above, kitchen before and after.

## New Wiring Puts New Life Into Old 2-Family House

Rewiring and multi-outlet systems update home,  
permit flexibility of furniture placement

When a young couple buys a home—even one that's older than they—it can be expected that they will want to enjoy modern living in it.

With that thought in mind, the Wallace Seidons gave first consideration to rewiring their two-family, three-story home. Adequate wiring and plenty of conveniently

located receptacles, they felt, would give them the opportunity to use the many portable electrical appliances they owned. At the same time, it would enable them to have the utmost flexibility in furniture placement.

Because the Seidons were to live on the second floor (the first floor  
*continued on third page*

### Code Comments

#### Receptacles in Kitchens

**Q.** What are some of the specific requirements for receptacles in kitchens in dwelling occupancies?

**A.** Paragraph 210-22(b) of the Code specifies that "Where an outlet is installed in the kitchen at the sink location this outlet shall be of the grounding type."

Paragraph 220-3(b) states that "For the small appliance load in kitchen, laundry, pantry, dining-room and breakfast-room of dwelling occupancies, two or more 20 ampere branch circuits in addition to the branch circuits specified in Paragraph 220-3(a) shall be provided for all receptacle outlets (other than outlets for clocks) in these rooms, and such circuits shall have no other outlets."

#### Grounding Portable Equipment

**Q.** When should portable equipment be grounded in other than residential occupancies?

**A.** The NEC, in Section 250-45, states: "under any of the following conditions, exposed non-current-carrying metal parts of portable equipment shall be grounded:

"(d) In other than residential occupancies, (1) portable appliances used in damp or wet locations, or by persons standing on the ground or on metal floors or working inside of metal tanks or boilers, and (2) portable tools which are likely to be used in wet and conductive locations shall be grounded except where supplied through an insulating transformer with ungrounded secondary of not over 50 volts."

WIREMOLD®



## Editorial

The old and the new

It is notable that Robert Martin Engelbrecht, architect of The American Home of the Immediate Future at the Seattle World's Fair, chose Plugmold to "create continuous outlets along the walls."

While Mr. Engelbrecht, who believes "electricity is a fundamental tool of design . . .," was specifying surface systems for a home of the future, another person was using it as part of the modernization of an older home.

Our feature story describes the use of Plugmold in the transformation of an older home to provide modern living convenience.

Doesn't this confirm what we've long maintained: Plugmold is the wiring system for electrical convenience for today and tomorrow.

## Product of the Month

Speed, appearance improved with internal corner coupling

Designed to speed installation by eliminating the need to fasten an elbow to the surface, 2017TC Internal Corner Coupling simply slides into the raceway base.

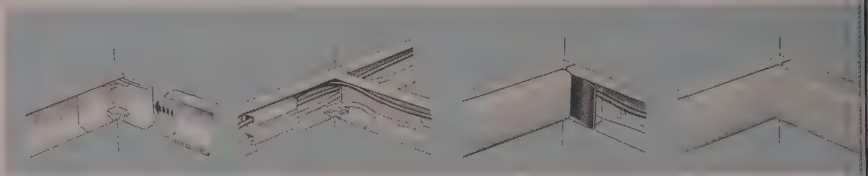
The raceway base is run right up to the corner with the 2017TC slipped into place. The adjoining raceway base is slipped onto the other end of the coupling and mounted to surface. The raceway cover becomes the cover of the fitting as well, making for a neat corner.

Economics, too, come into play. The 2017TC coupling is less ex-

pensive to buy and, because of time and labor saved, more economical to install than the elbow.

In addition to its use as an internal corner coupling, the 2017TC also can be used as a combination corner coupling and straight through fitting. This permits going through a partition at the same time, and with the same fitting, the partition corner is turned and the wall wired.

The 17TC couplings are available also in the 2100, 2200 and 3000 series.



## Quiz Corner

Questions for this department are taken from inquiries received from the field. Your questions are welcome; indeed, they are necessary if this department is to serve you with worthwhile information. Address:

Quiz Corner  
The Wiremold Company  
Hartford 10, Conn.

**Q.** Is Plugmold available in buff or gray finish with ivory outlets?

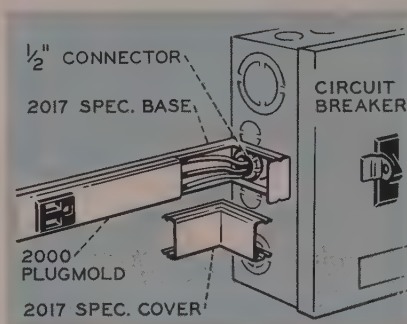
**A.** The Snapicoil® series are available in buff or gray finish with black or ivory outlets. Ivory outlets in wired sections are available on special order, with base and cover in buff or gray. Specify "V" at end of catalog number for ivory outlets.

**Q.** Is there a fitting for connection of 1/2" pipe to Wiremold 200?

**A.** No, at present there is no single fitting to connect 1/2" pipe to Wiremold 200. However, this can be accomplished by using a

5782 conduit connector or 5784 elbow conduit connector and a 289 reducing connector.

**Q.** What would your suggestion be for installing a circuit breaker at the end of a strip of Plugmold 2000?



**A.** Through the use of a 2017 Special elbow.

**Q.** Is there a blank end fitting to fit 2600 overfloor duct, to terminate a run of 2600 in the middle of a room?

**A.** No, use the 2642D junction box.

**Q.** How can I make an irregular turn with one-piece Wiremold?

**A.** Use flexible section 2005700F, or 1000F.

**Q.** Is there a grounding receptacle for use with Wiremold 200?

**A.** Yes, 57243G.

WIREMOLD ■ HARTFORD 10, CONN.

Gentlemen: Please send free the checked items

NAME \_\_\_\_\_ ☐ Electric Ideas, August, 1962  
COMPANY \_\_\_\_\_ ☐ Electric Ideas, July, 1962  
ADDRESS \_\_\_\_\_ ☐ Wiring Guide (Catalog 22)

**WIREMOLD®**



## New Wiring Puts New Life *continued from first page*



HAZARDS like this were common when one circuit serviced entire apartment.



AS NEW-LOOKING as the baby that occupies the nursery, this room is now serviced by two circuits and has plenty of receptacles for the many electrical items needed.

was occupied at the time of purchase), they turned their attention first to that area, although some modernization was done to the other apartment.

Prior to remodeling, the service to the house was 120-v., 60-amp., breaking 30-amp. to each of two meters. The two apartments, each consisting of four rooms, had a single circuit per apartment.

The new service consisting of 240-v., 200-amp. was brought in. It was split so that each apartment had 100-amp. service.

For the first floor, the original circuit was split to a total of four effective circuits and one spare circuit for the attic. This reduced the load carried by the original circuit and made it possible for the tenants to use many electrical conveniences

which had not been possible before. Major remodeling was left for a future date.

The spare circuit for the attic is intended for whatever future use may be decided.

Because the Seidons wished to make as few structural changes as possible in their apartment, they decided on a perimeter layout of Plugmold 2200 with alternately wired, grounding receptacles 30-in. on centers for the two bedrooms and living room.

An area above the baseboard was cut away for the feed wires (No. 12 armored cable) and for the new heating system. (The apartment had been heated by a kerosene burner in the living room and by a combination coal and gas stove in the kitchen.)

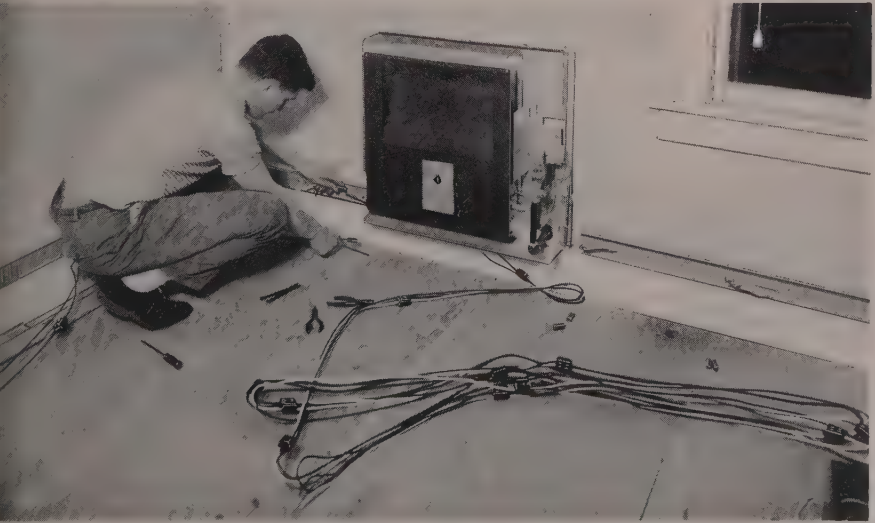
Once the feed wires were in, 3/8-in. sheet rock was used to cover the old wood lath and plaster walls. The Plugmold® 2200 was then run above the old wood baseboard in every room but the kitchen and Plugmold 2000 placed in position in that room.

Here, two types of wired sections were used: six-foot sections with grounding outlets 12-in. on centers, and 5-ft. lengths with grounding outlets 9-in. on centers. Two Wiremold 20FL units were placed under each bank of cabinets for fluorescent lighting of the counters beneath.

When completed, wiring in the second floor was divided in the following manner:

The original circuit carries kitchen ceiling light (switched), bathroom ceiling light and medicine cabinet light, alternated receptacles (hot 22GA30) in the two bedrooms and one half of the alternated receptacles (22GA30) in the living room, and the front and rear hall lights (total of two lights).

The new circuits carry a 240-v., 50-amp. circuit for kitchen range, three 120-v., 20-amp. circuits for the kitchen, one 120-v., 15-amp. (switched 22GA30) in the master bedroom, one 120-v., 15-amp. (switched 22GA30) in the nursery, and two 120-v., 15-amp. spare circuits in the attic.



AFTER NEW feed wires were brought in, Plugmold 22GA30 was installed along perimeter of rooms. The original single circuit was used to feed some of the alternated outlets.

**WIREMOLD®**



# Engineered Specials

Fitting developed for feeding 2100 from side of 3000

## PROBLEM:

To provide a method of feeding Wiremold 2100 from the side of a run of Wiremold 3000 so that conductors could be installed without having to be threaded through a connector fitting.

## SOLUTION:

The ED-30974 was developed by Wiremold engineers to permit feeding the 2100 raceway without the use of a box or other external fitting.

## DISCUSSION:

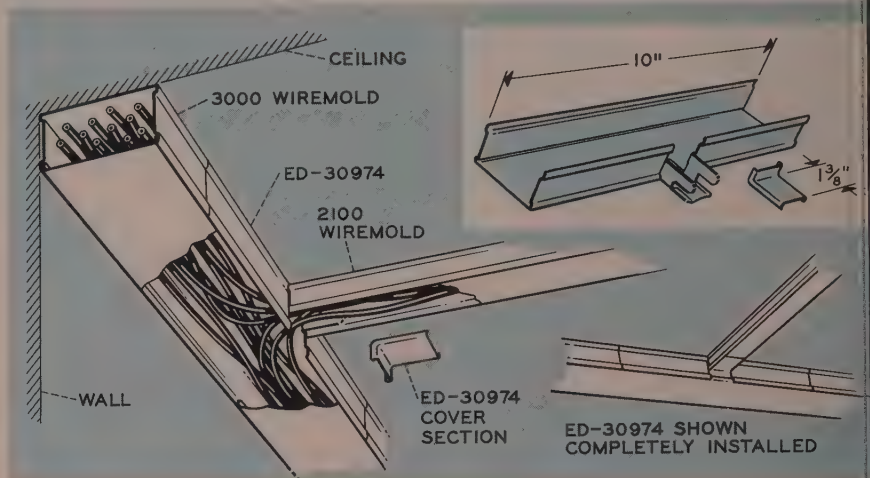
For illuminating a store, it was decided to use a 3000 feeder system, then taking off from it with 2100 to power the lighting fixtures.

The fixtures were to be mounted tightly against the 2100. For the sake of appearance, it was important that the feeding of the 2100 be done as neatly as possible.

The side of the 3000 base was notched to the width of the 2100 at required intervals. A coupling was welded in place to form a modified 3015 tee.

The base of the 2100 raceway was then attached to the leg of the tee, providing a simple, neat method of feeding the smaller raceway.

After the wires were installed, Special 2117TC Cover was snapped into place so that one leg formed part of the raceway cover and the other leg filled the gap in the side of the 3000 caused by the difference in depth between the raceway. Standard 2100 and 3000 cover sections were used to complete the run.



## Noteworthy

### Personnel at Meetings

Robert T. Bennett, Boston, and Henning A. Thomsen, Home Office, will represent Wiremold at the Eastern Section, IAEI meeting at the Mount Washington Hotel, Bretton Woods, N.H., Sept. 10-12 while John D. Murphy, president, and William E. Parks, sales manager, electrical division, will attend the Western Regional Convention of NAED at the Empress Hotel, Victoria, B. C., Sept. 16-19.



Bob Bennett    Henning Thomsen    John Murphy    Bill Parks

## Practical Tips

### Fittings designed for in-field requirements

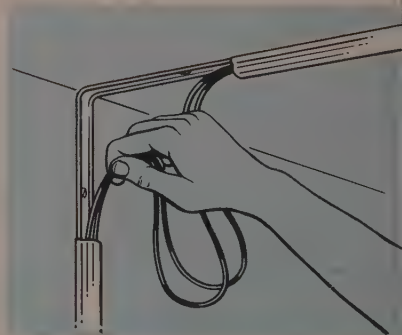
Tools and fittings for Wiremold one-piece raceway are designed for maximum efficiency and ease of installation. There is a fitting for every need; yet a minimum number handles most requirements, with virtually every fitting acting as a pull box.

Many Wiremold fittings were developed in cooperation with contractors to solve real field problems, thereby adding to the practicality and economy of the system.

All fittings are quickly and easily connected to the raceway by the slip-joint method. Each length of raceway comes with a coupling that mechanically aligns lengths; insures electrical continuity of ground; and

acts as a means of fastening and support.

Wiremold one-piece raceways are a complete system, completely interconnectable with each other and other systems.



# WIREMOLD®

HARTFORD 10, CONNECTICUT

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All WIREMOLD products are sold through electrical distributors — your best source for all electrical products.



*a comprehensive guide to current  
information on every branch of  
Science and Technology*

*... a practical new way to bridge the gap between your  
specialty and other fields into which your work leads you*

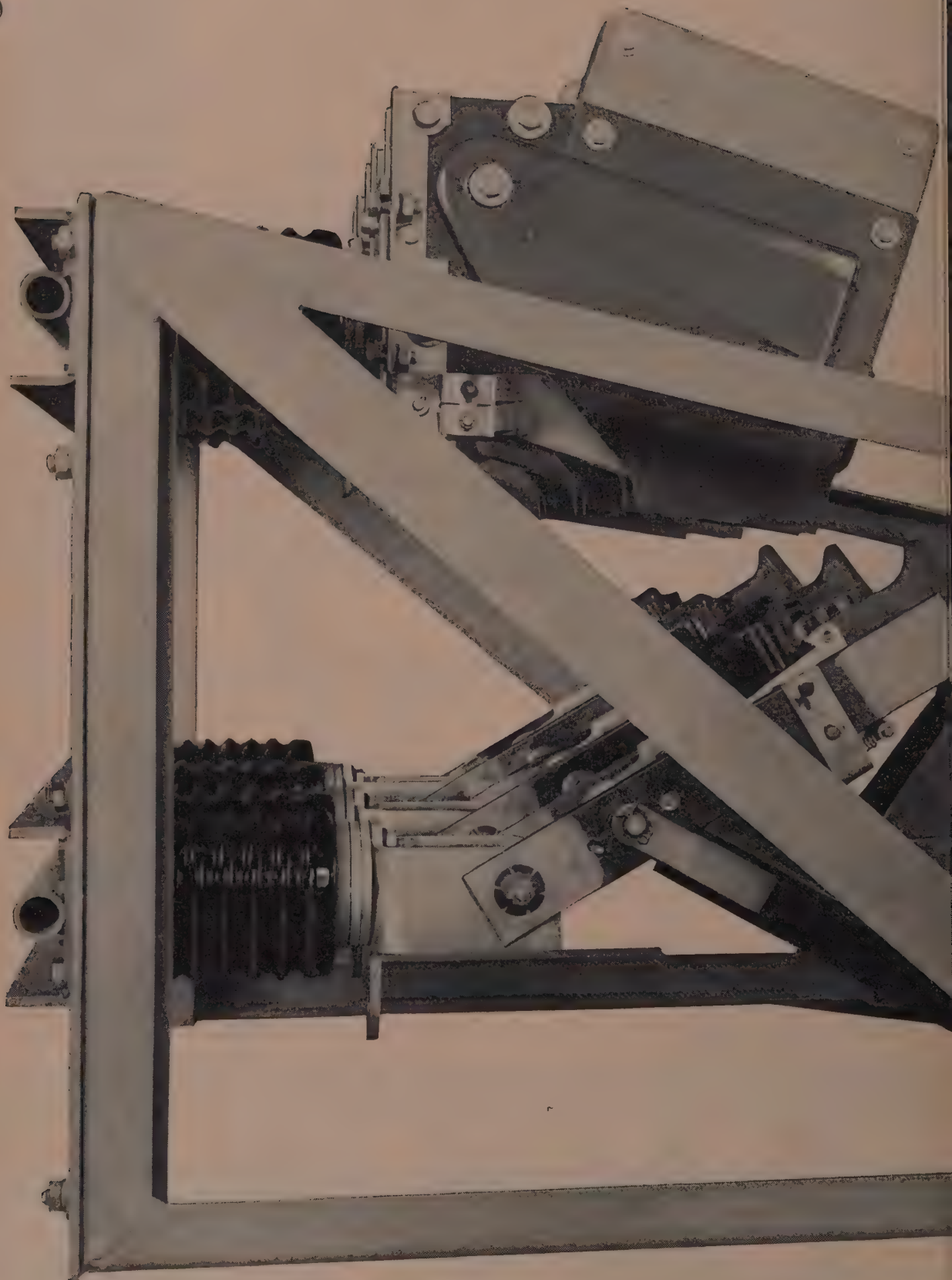
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**VALUE**







# Low-cost Protection

General Electric stationary switch and fuse equipment is designed to fully meet your light-duty switching and fault-current protection needs. G-E switch and fuse equipment gives you quality where it counts.

**Non-expendable arc chutes** are made of the same high quality phospho-asbestos compound as the chutes in G-E magne blast power circuit breakers. Manufactured to extremely fine tolerances, these chutes have high performance characteristics and long life.

**Current-limiting fuses** are on the source side of the load-break switch to provide better protection. Fuses limit short-circuit currents to values far below harmful levels in  $\frac{1}{2}$  cycle or less to prevent damage to protected equipment. And interruption is clean—since there's no discharge when fuses interrupt and no dangerous gas build-up.

**Stored energy switching** provides consistent, positive make and break to lengthen contact life, reduce maintenance, and provide greater safety.

It makes good sense to install reliable, low-cost switch and fuse equipment when the benefits of metal-clad switchgear's higher ratings, repetitive interrupting capabilities, sensitivity to single-phasing and ground-fault currents, are not required.

Examine your system. If fused overcurrent protection is justified, and switching requirements do not exceed 13.8 kv, look into the economies of General Electric stationary switch and fuse equipment.

In addition to stationary switch and fuse or rollout switch and fuse, G.E. offers a full range of voltages and capacities in the metal-clad switchgear line.

For more information, talk to your General Electric sales engineer, or write for bulletin GEA-7718. Sect. 514-01, General Electric, Schenectady 5, N.Y.

GENERAL  ELECTRIC



# Sylvania's New **Power-V** Series

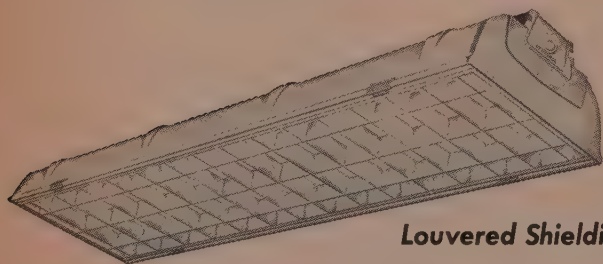
makes your  
Lighting Installation  
**EASIER-FASTER-SAFER**

Sylvania's new Power-V Series has been designed and built with you in mind . . . to provide money-saving methods of reducing installation time.

This, plus the built-in features of ruggedness, neatness, power, versatility and simplicity, make Sylvania Power-V the outstanding line of industrial fixtures available.

Ask your Sylvania representative or your Sylvania Select Distributor for details. Or write to:

SYLVANIA LIGHTING PRODUCTS  
A Division of SYLVANIA ELECTRIC PRODUCTS INC.  
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**Louvered Shielding**

A variety of louvered, lens and panel shieldings can be used with Sylvania's Power-V Series. The door frame (which can swing down from either side) holds the shielding firmly in position to withstand sudden jars or shocks.

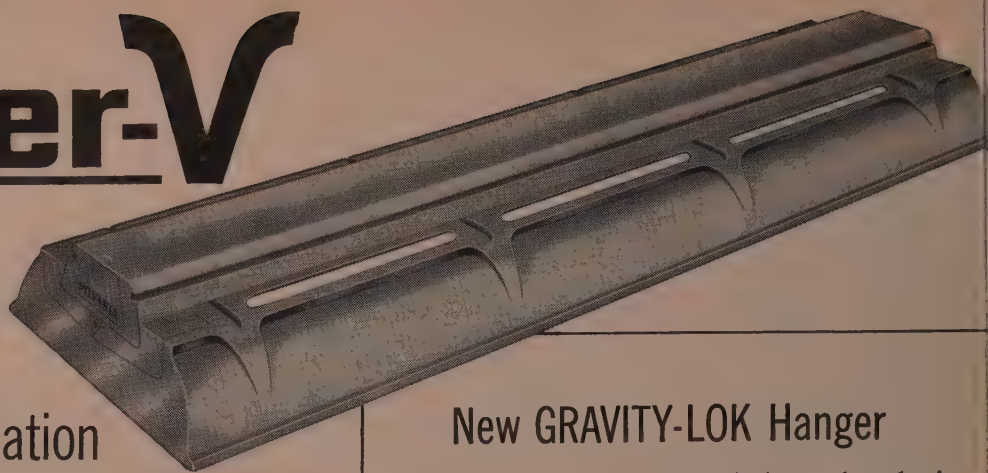
The Power-V with 800 ma HO or 1500 ma lamps and 30° x 30° metal cell louver shielding is gaining popularity for the general illumination of areas where more critical visual tasks are performed.

**LIGHTING FIXTURES BY**

# SYLVANIA

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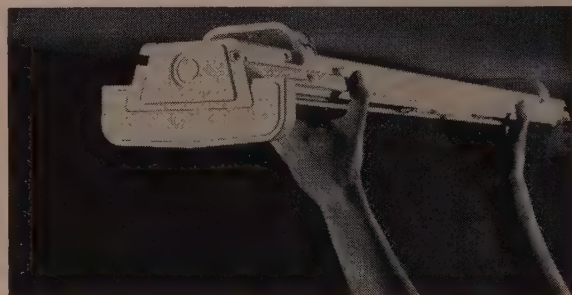


### New GRAVITY-LOK Hanger

This new Sylvania hanging device makes the installation of Power-V fixtures as simple as 1-2-3. Ask for a demonstration in your own office.



After Gravity-Lok Hanger is fastened or suspended, engage groove of one side of fixture channel into lip of stationary side of Gravity-Lok Hanger.



Rotate fixture into position. Movable clamp of Gravity-Lok Hanger moves aside as channel is pushed upward. Clamp then falls into groove on channel holding it in place. Then tighten screw on side of Gravity-Lok Hanger to prevent lengthwise movement of channel, when desirable.





## SPECIFICATION: QUIET

This switch has been turned on and off over three million times! Still working—still quiet—it is dramatic proof of the reliability Leviton builds into every one of its switches. ☐ Few switches will ever be operated as often in actual use. The fact that ours can — and does — is your assurance of uncompromised quality and dependability. Testing of a Leviton device calls for the equivalent of twenty years of heavy usage under four types of loads, and seventeen tests to check reliability. Only after our products have exceeded these requirements are they permitted to meet yours. ☐ Whether it's "Specification: Quiet," or any other specification, chances are there's an economical, dependable Leviton device to meet it. Over twenty different Quiet Switches! Over 2,000 standard wiring devices! You'll find them all in our new 1962 catalog. Write for your copy today. Dept. EC-3, Leviton Manufacturing Company, Inc., Brooklyn 22, New York.



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VISIT US AT THE NECA CONVENTION AT MINNEAPOLIS, OCTOBER 10-13, BOOTHS #196-197



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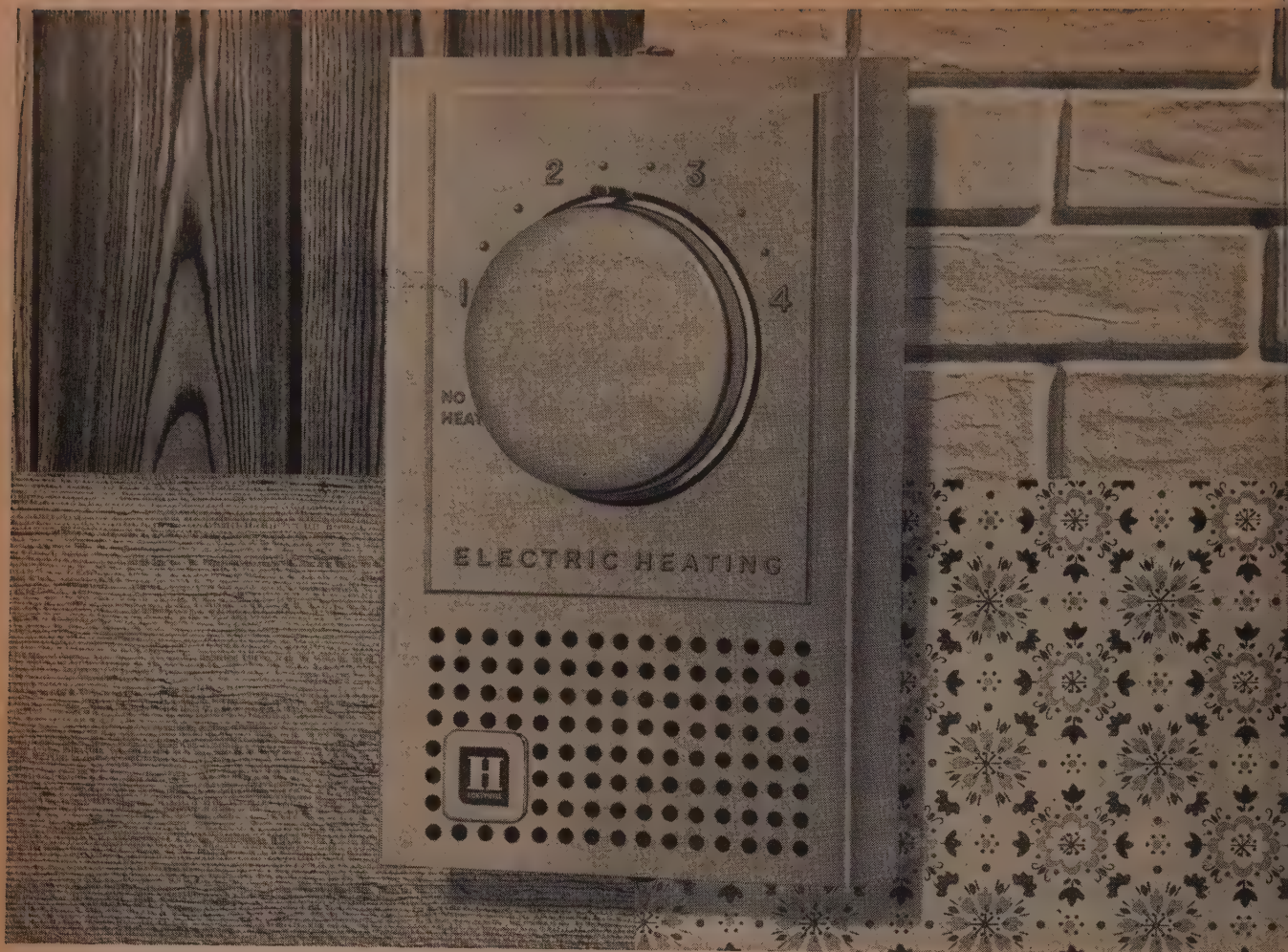
## No other type of conduit is so easy to thread, costs so little to install

It stands to reason: with a sharp regular die, Alcoa *aluminum* electrical rigid conduit is much easier to thread. And that's only one of the ways aluminum conduit saves time and money in installation. It's much easier to cut, too. Easier to bend. Easier to carry and position, because it's so much lighter. □ Alcoa aluminum rigid conduit is priced competitively. It is naturally corrosion-resistant: needs no painting or other protection. It's non-magnetic. Non-sparking. And it has a smooth, specially-lubricated interior that makes cable-pulling go a little faster. □ In short, Alcoa aluminum electrical rigid conduit makes a better installation at lower cost. Find out for yourself: ask your Alcoa-Rome representative or distributor for the facts and figures. Or write to Rome Cable Division of Alcoa, Department E2, Rome, New York.

CONFORMS TO ASA C80.5-1960—RIGID ALUMINUM CONDUIT AND FEDERAL SPECIFICATION WW C-540A







## Put the Honeywell preference to work for you with the stylish New Honeywell Line-Voltage Electric Heat Thermostat

When Honeywell is on the wall, you're offering what Homeowners want (3 out of 4 prefer Honeywell controls according to a recent survey in cities across the country).

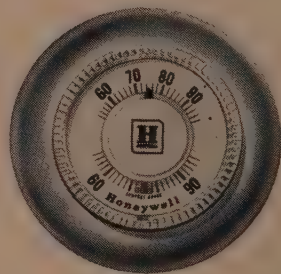
The wall-mounted T462 (above) and its integral unit-mounted counterpart—the T460—are the ideal line-voltage home thermostats. New construction makes them stronger. Now easier to set, too. Rugged and dependable—yet precise ( $\frac{1}{2}^{\circ}$  differential) switching for operating electric heaters up to 5000 watts, responding to both radiant and convected room heat.

Get the facts about Honeywell. Just call the nearest Honeywell office or write: Honeywell, Dept. EC9-25, Minneapolis 8, Minnesota.

*Two switching variations available: T462A and T460C are SPST, make on temperature fall, break line in NO HEAT position. T462B and T460D have the added feature of breaking both lines in the OFF position.*

**NEW, EXCLUSIVE ELECTRIC HEAT TRAINING PROGRAM!**  
Another Honeywell first! Sales and service meetings studying a new and thorough working manual: "Fundamentals of Automatic Electric Heating." Call the Honeywell office nearest you about the next session.

Honeywell  
Low-Voltage  
Round



Consider Honeywell low-voltage controls, too. With versatile R8097 Relay, you can offer the widest range of low-voltage thermostat combinations in the electric heating industry. You have complete choice from the most economical to the famous Honeywell Round to the deluxe thermostats and Control Centers.

# Honeywell



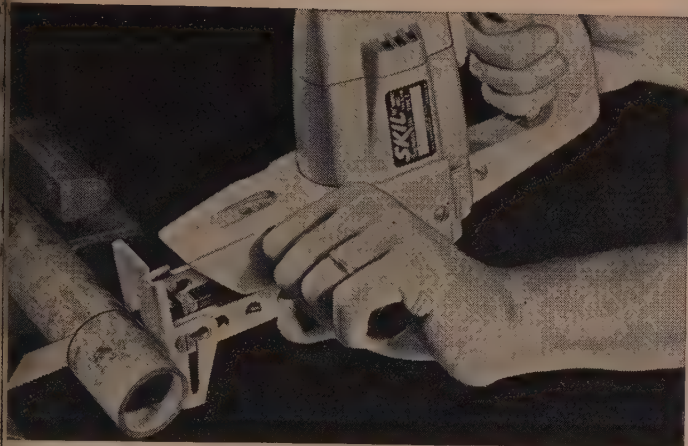
*First in Control*



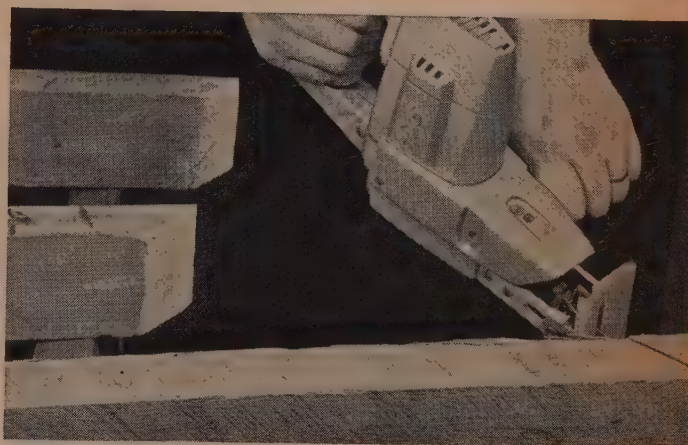
# FIRST ALL-PURPOSE SAW PRICED UNDER \$50!



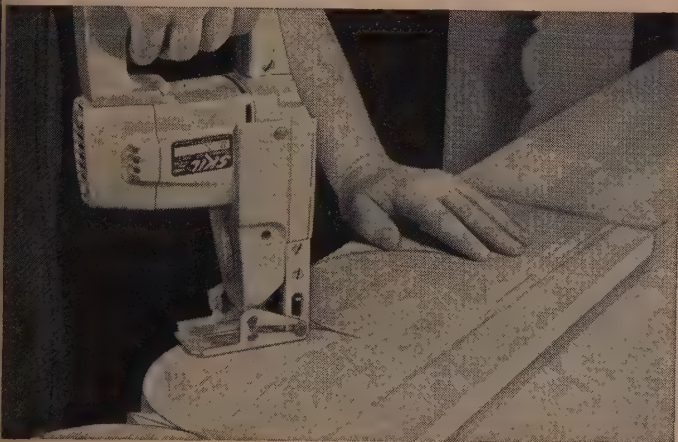
...and look at the jobs the new Skil Recipro Saw does!



**Cuts metal**—including pipe, conduit, tubing, angle, sheet metal, bar stock, aluminum, soil pipe and more.



**Cuts wood** up to 6-inches thick (even with nails). Perfect for pocket cuts and notching work in joists and studding.

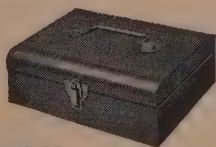


**Cuts like a jig saw**—makes intricate scroll cuts, pattern cuts and template cuts in wood, metal, plastic, etc.



**Cuts where other saws can't** for installing registers, junction boxes, heating ducts. Flush-cuts into corners.

NOW you can get a genuine Skil Recipro Saw (Model 577) at one-half the cost of other all-purpose saws. And with features of far more expensive models, including: double-reduction gears, a 4-position foot, 3-position handle, automatic sawdust blower, canted blade for faster cutting.



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See your Skil distributor now for a demonstration. He's listed under "Tools-Electric" in the Yellow Pages. Or write: Skil Corporation, Dept. 130-I, 5033 Elston Avenue, Chicago 30, Ill.

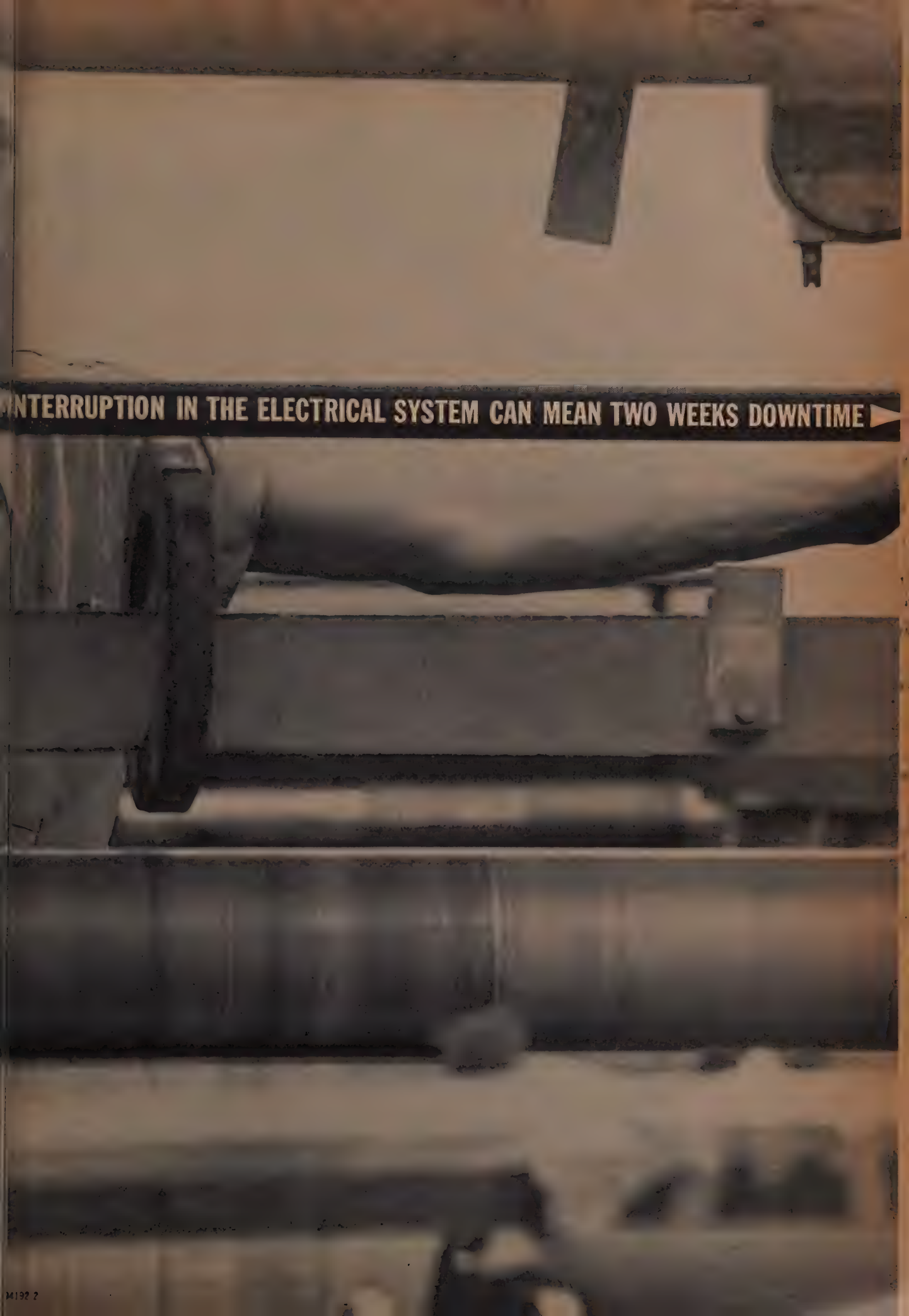
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**INTERRUPTION IN THE ELECTRICAL SYSTEM CAN MEAN TWO WEEKS DOWNTIME**



## O CROWN-ZELLERBACH MADE SURE ELECTRICAL COMPONENTS WERE WESTINGHOUSE

In St. Louis, Mo., Crown Zellerbach Corporation recently constructed a new 220,000-sq. ft. plant for their Western Waxide Division, producers of flexible packaging materials including wax paper labels and wrappers. In a month's time, hundreds of thousands of pounds of liquid wax is processed through the plant. If a power failure were to occur for just a few hours, and wax in various pipelines solidified, a two-week layoff would be necessary to get back to production. Components of the electrical system are therefore confronted with very heavy responsibility.

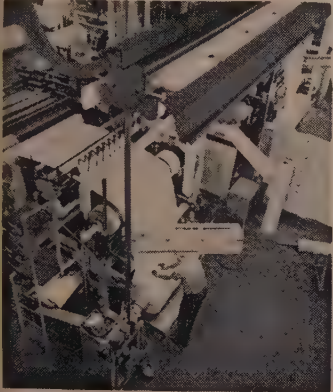
It is in requirements like this where Westinghouse electrical equipment and engineering know-how works to best advantage. To minimize maintenance, no fuses are used in the plant's electrical system. Previous experience with Westinghouse led to customer specification for a completely air-conditioned plant. Westinghouse quality equipment, local distributor stockpiling, and sales follow-through led to a coordinated construction schedule. All important reasons why, You can be sure . . . if it's Westinghouse.

**CREDITS:** Owner: Crown-Zellerbach Corporation, San Francisco, Calif. Architect and Engineer: Robert C. Martin and Associates, Los Angeles, Calif. Electrical Contractor: John Ledbetter Electric Co., St. Louis, Mo. Westinghouse distributor: WESCO, St. Louis, Mo.

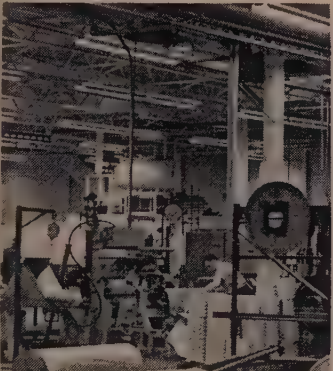




In executive offices like this or in general offices, ☺ Mainliner luminaires add distinctive styling and high lighting levels.



Ceiling view shows intensified illumination cast by ☺ Heavy-duty Industrial luminaire on one of the letterpress printing machines.



Plant view shows consistent evenness of ☺ Heavy-duty Industrial lighting. A more than adequate 32-ft. candles is averaged by these 2WSOS two-lamp luminaires.



Discussing a ☺ combination Motor Control Center and Switchboard arrangement are S. N. Kraines, Waxide's Senior Indust. Engineer, Emil Zolezzi and Vince Kelly. New design, shallow depth switchboard matches control center, contains molded case circuit breakers feeding power circuits.

Discussing a ☺ Life-Line Starter located at a laminator waxing machine are J. R. Miller, ☺ Construction, and John Day, Project Engineer, A. C. Martin & Assoc.



Centralized control at tank mixer provided by ☺ Class 11-350 Motor Control Center. Stacked starter units can be interchanged, are engineered to reduce hazards and are easy to maintain and install. Left to right on platform are: Hal Forister, ☺, Emil Zolezzi, Tom Fogarty, V. P., Ledbetter Electric, and S. N. Kraines.



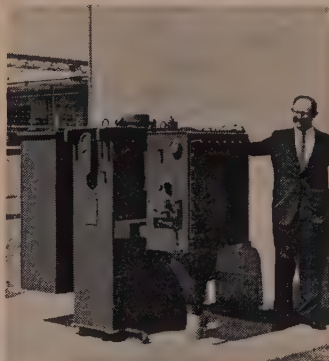
Emil Zolezzi, WESCO, and Vince Kelly, Ledbetter Electric's Superintendent, discuss ☺ type NLAB Panelboard. A compact, lightweight 75-Kva Dry-type DT-3 Transformer was easily mounted overhead, providing 120/208 V.



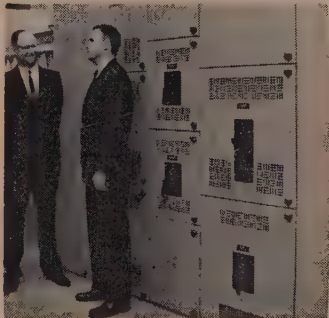
Hal Forister, ☺, explains function of 15 Kv main 150 DH250 air-circuit breaker in this metal clad switchgear line-up to Messrs. Kraines, Fogarty and Zolezzi. Plant's distribution system is designed so that in case of fault, one power center feeder can be isolated while others still operate.



Discussing the ease of operation of a starter unit are Messrs. Forister, Fogarty and Kraines. This motor control center uses combination Life-Line Starters for fast, positive protection of all mechanical equipment room motors.



Paul Olschner, WELCO Dist. Const. Mgr., St. Louis, shown at a 150-Kva outdoor Inerteen® power center. This completely self-contained unit, with non-flammable coolant, provides circuit protection and supplies power to an emergency fire pump for plant protection.



Messrs. Olschner and Miller view Type DB Circuit Breakers used in the LV switchgear end of a 750-Kva Power Center. Type DB breakers are well applied in industrial plants where power switching and protection is required. Draw-out feature allows easy maintenance.



Westinghouse





**SYMMETRY OF MAGNETIC FIELDS . . . A DESIGN BONUS WITH BULLDOG LO-X® BUSTRIBUTION® DUCT. PAIRED PHASING GIVES MINIMUM IMPEDANCE, EQUAL VOLTAGE DROP IN EACH PHASE, NO UNBALANCE. THE ADVANTAGE: MAXIMUM ELECTRICAL EFFICIENCY AND COOLER DUCT OPERATION. CONTACT YOUR LOCAL I-T-E SALES OFFICE . . . IMAGINEERING THROUGH ELECTRICITY.**



**I-T-E CIRCUIT BREAKER COMPANY**  
BULLDOG ELECTRIC PRODUCTS DIVISION

BOX 177 • DETROIT 32, MICHIGAN

In Canada: 80 Clayson Rd., Toronto, Weston, Ont.



## *The Nonconformist*

Going over a complex installation with an electrical contractor a few weeks ago, we discovered that he had negotiated and coordinated the entire project which involved several other trades. He reported that when he proposed the procedure, it was not only quickly accepted, but the customer was actually grateful to be relieved of the many details involved. The job is also expected to return a quite adequate profit.

Such odd behavior can be forgiven because the contractor is a young man who has been exposed to some training in modern business administration and he is, perhaps, not yet fully aware of the importance of following traditional procedures in the electrical contracting business. An older experienced hand could quickly detect a quite lengthy list of serious departures from conventional practice.

For example, he approached the customer without a written invitation to bid. This is not only unconventional but it fails to convey the impression of granting a substantial favor which everyone knows is necessary to keep the customer in his proper place. Also, he did not insist upon being the low bidder and, perhaps worse, he negotiated the contract and there were no other bidders. As a consequence of his unusual tactics, from twelve to twenty good electrical contractors were denied the opportunity to prepare estimates—a procedure which normally occupies the time and attention of some of the industry's most talented people.

In undertaking to coordinate the entire project, he is obviously far afield from standard practice. Electrical contracting alone is a difficult and exacting business. The contractor has plenty of his own problems to compel his undivided attention. Why then should he concern himself with his customer's problems? If he does, who knows what outlandish projects the customer might ask him to handle?

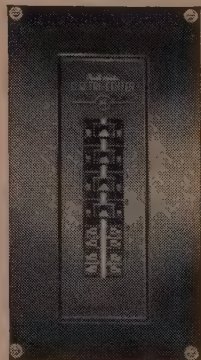
Performing the work at a profit is, beyond question, his most serious departure from accepted procedures. Electrical contracting is an exciting game, rich in intangible rewards for those who will throw their hearts and fortunes into it. The accepted industry rule would appear to be that profit is optional, preferably modest and achieved only in return for substantial risks.

*Wm. T. Stuart*





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GIVE POSITIVE, FOOLPROOF CONTACT. NO CALLBACKS. BUY TOP  
QUALITY, ABSOLUTE DEPENDABILITY . . . BUY PUSHMATIC. SEE YOUR  
I-T-E DISTRIBUTOR OR YOUR LOCAL I-T-E SALES OFFICE TODAY!!!



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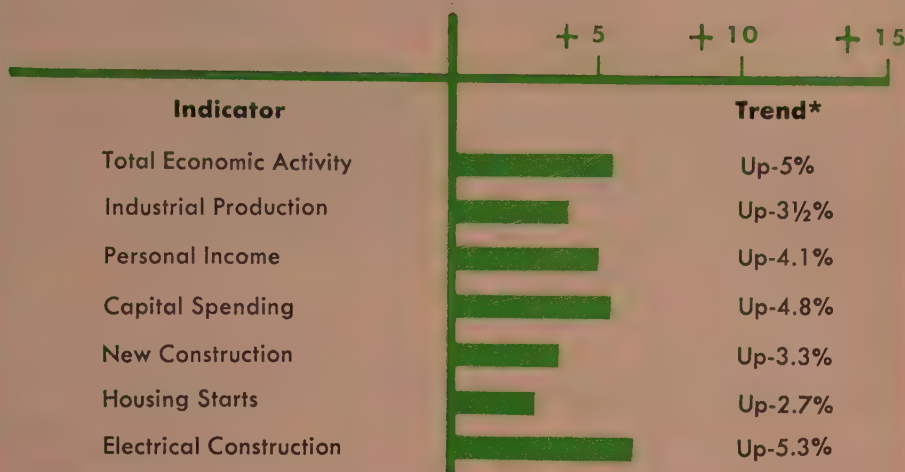
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**EIGHTH ANNUAL STATISTICAL SUMMARY**

**ECONOMIC OUTLOOK**

(Trends for 1963)



\*Change from 1962. E. I. C. & M. estimate, mid-1962.

**TRENDS INDICATE**

# **Sound Growth IN Electrical Markets**

Growing demand, increased spending, and renewed business confidence are reflected by current trends, notwithstanding the recent slowdown in economic activity. These factors, plus an optimistic outlook for new construction, point to continuing growth in the electrical industry.

By Berlon C. Cooper

## **THE NATIONAL ECONOMY**

**T**HE American economy is now at its highest level in history. Also, most of the basic requirements for continued economic growth seem to be present at this time. Thus, for the remaining quarter of 1962, and for the year 1963, the outlook for the electrical industry is for continued growth.

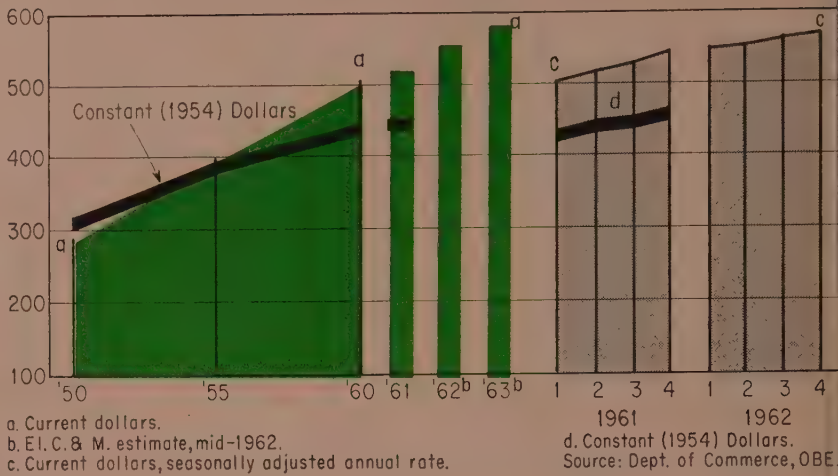
This outlook may appear to be highly optimistic, especially when the pessimism of the headlines during the spring and summer months, and the worry about the state of the economy during the same period, are considered. This pessimism and worry would seem to have been overemphasized, how-

ever, in the light of the trends of various economic barometers which are presented in the following statistical summary. Also, it would seem to have been overplayed in view of President Kennedy's decision in mid-August not to ask for tax cuts, which were being urged by many groups at that time, to



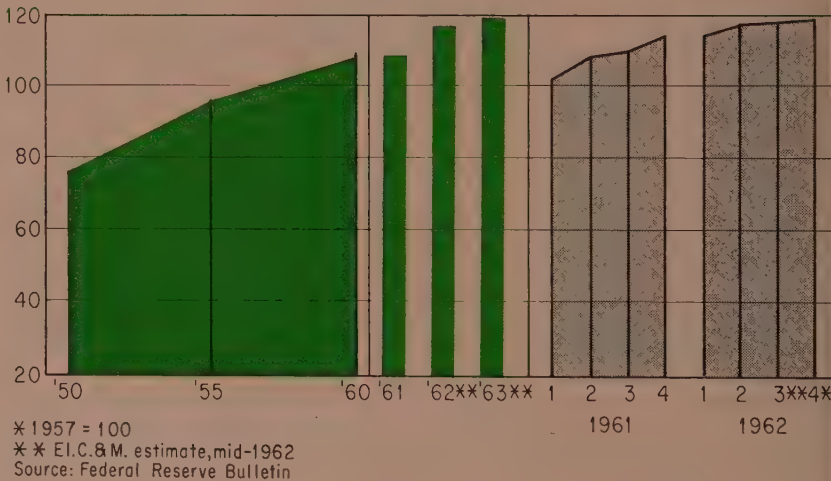
GROSS NATIONAL PRODUCT  
(Billions of Dollars)

Economic growth over the 11-year period of 1950 through 1961 totaled 83%, or an average annual increase of 7.5% per year, based on current prices. Measured in constant (1954) dollars, the actual physical growth was 41% for the period. Estimated growth for 1962 is 6.8%, based on current prices, or only slightly below the 11-year annual average. The forecast for 1963, based on current trends, is for an increase of 5%.



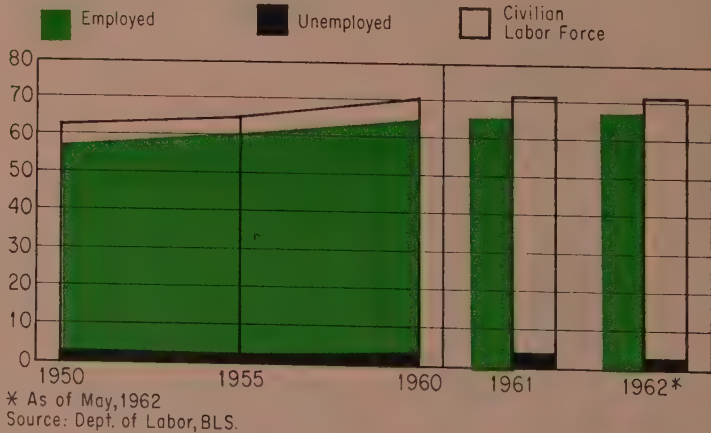
INDUSTRIAL PRODUCTION  
(FRB Index)\*

Industrial output is at an all-time high rate, except in steel, as was evidenced by the record high FRB Index of 118 for June of this year. Inventories are at a low level, and demand for goods, including steel, is on the increase. Thus the outlook for industrial production is good and for continuing growth.



EMPLOYMENT AND UNEMPLOYMENT  
(Millions of Persons)

Unemployment in June increased seasonally to 5.9% of the civilian labor force, as a new group of students started looking for jobs. Meanwhile, employment was at a record high of 69.5 million in June.





further speed economic growth.

The recent pessimism and worry, however, are not due entirely to the slowdown in the economy which has been reflected by the monthly statistics. This slowdown has helped, rather, to confirm fears which have resulted from other actions. These fears were an outgrowth of President Kennedy's crackdown on price increases proposed by the steel industry in April of this year, and of the subsequent stock market break in prices. In essence, businessmen interpreted the price crackdown action as an effort on the part of Government to inject further control of business, and as a further squeeze on profits, holders of stocks and investments decided that further profits-squeezing would curtail dividends on their investments. Thus, the pessimism and worry about the status and growth of the economy was a reflection of a lack of confidence in the nation's future under the guidance of an Administration which has exhibited many anti-business tendencies.

Presented here, for the eighth consecutive year, is a roundup of statistics covering both the national economy and the electrical industry. This year, the statistics are selected to provide both a long-range and a short-range view of trends. The long-range trends are indicated by the figures for 1950, 1955 and 1960, which provide a sufficiently broad base to show the general trend. The short-range trends can be interpreted by the figures on an annual basis for 1960, 1961 and 1962. Thus each chart or table in general accomplishes two purposes, and should be analyzed from that standpoint.

### Economic Trends

Based on the trends shown by various economic barometers, and taking into account current demands, inventory status, and spending plans by business, government and consumers, the outlook for the economy in 1963, as measured by certain indicators, is summarized in the chart "Economic Outlook." Note that the trend is "up" for each of the seven indicators shown. The increases shown are not spectacular, but all do represent continued growth. The status of the economy at this time is such that no real boom period is in sight. On the other hand, neither is a recession of any mag-

## PERSONAL INCOME, TAXES, DISPOSABLE PERSONAL INCOME

(Billions of Dollars)

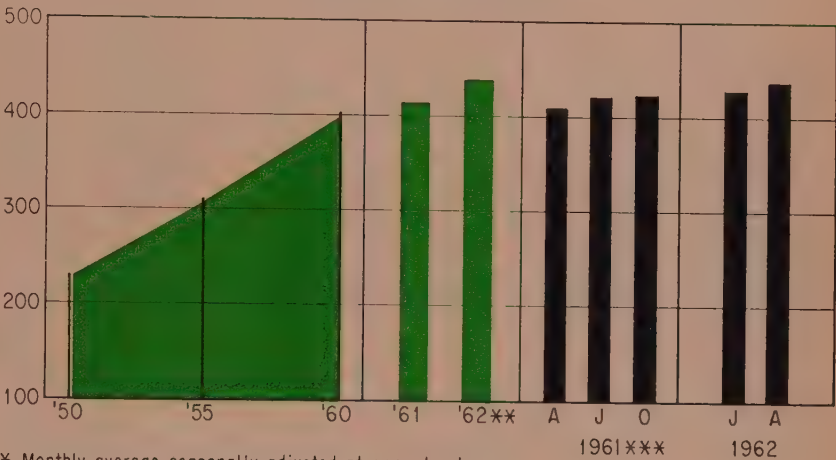
| Year        | Personal Income | Taxes   |       | Disposable Personal Income |
|-------------|-----------------|---------|-------|----------------------------|
|             |                 | Federal | State |                            |
| 1950 .....  | 228.5           | 18.2    | 2.6   | 207.7                      |
| 1955 .....  | 310.2           | 31.5    | 4.2   | 274.5                      |
| 1960 .....  | 402.2           | 43.2    | 7.2   | 351.8                      |
| 1961 .....  | 416.7           | 43.9    | 8.0   | 364.9                      |
| 1962* ..... | 432.9           | 46.0    | 8.7   | 378.2                      |

\* First quarter, at seasonally adjusted annual rate.  
Source: Dept. of Commerce, OBE.

Personal income has increased 90% over the past 12 years (1950 to 1962), while personal taxes (Federal and State) have increased 163%. The increase in disposable personal income is 82%. Thus, while personal income has continued its upward climb, consumers spend directly over 2.6 times as much on government as in 1950, and have a smaller percentage left for goods, services, and savings.

### PERSONAL INCOME

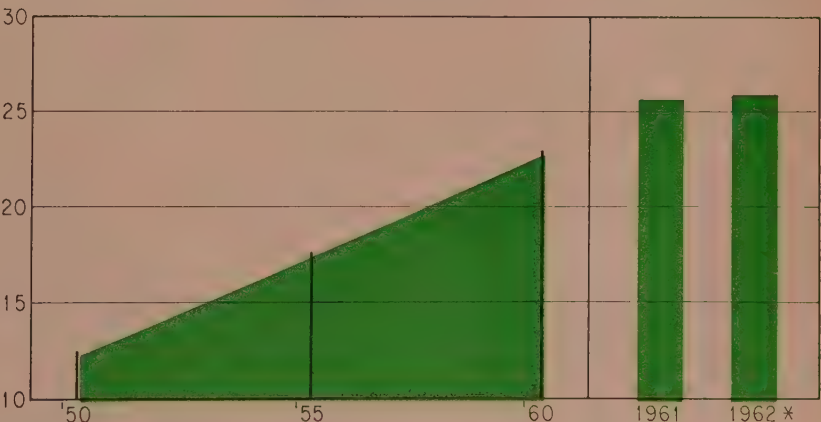
(Billions of Dollars)\*



\* Monthly average, seasonally adjusted at annual rates.  
\*\* El. C. & M. estimate, mid-1962.  
\*\*\* Seasonally adjusted, at annual rates.  
Source: Dept. of Commerce, OBE.

### PERSONAL SAVINGS

(Billions of Dollars)



\* 1st quarter, seasonally adjusted annual rate.  
Source: Dept. of Commerce, OBE.



## CONSUMER SPENDING

(Billions of Dollars)

| Year     | Durable Goods | Nondurable Goods | Services | Personal Consumption Expenditures |
|----------|---------------|------------------|----------|-----------------------------------|
| 1950...  | 30.4          | 99.8             | 64.9     | 195.0                             |
| 1955...  | 39.6          | 124.8            | 92.5     | 256.9                             |
| 1960...  | 44.3          | 152.4            | 132.2    | 328.9                             |
| 1961...  | 42.3          | 155.5            | 141.2    | 339.0                             |
| 1962*... | 44.8          | 159.8            | 147.3    | 352.0                             |

\* First quarter only, seasonally adjusted annual rate.  
Source: Dept. of Commerce, OBE.

## CONSUMER CREDIT

(Billions of Dollars)

| Year       | Installment Credit | Noninstallment Credit | Total Consumer Credit |
|------------|--------------------|-----------------------|-----------------------|
| 1950.....  | 14.7               | 6.8                   | 21.5                  |
| 1955.....  | 29.0               | 9.9                   | 38.9                  |
| 1960.....  | 43.3               | 12.8                  | 56.1                  |
| 1961.....  | 43.2               | 14.0                  | 57.2                  |
| 1962*..... | 43.3               | 13.4                  | 56.7                  |

\* Outstanding, as of April, 1962.  
Source: Board of Governors of Federal Reserve System.

In 1962 consumers will spend 93% of their disposable income for goods and services; 12% for durable goods; 42% for nondurable goods; and 39% for services. Remaining 7% will go into savings. With personal savings at new highs in 1961 and 1962, consumer credit has declined slightly.

nitude indicated. With President Kennedy's decision in mid-August not to ask for a "quickie" tax cut, for the purpose of spurring economic growth, the nation's business climate seemed to improve. Further, the President's promise to recommend an across-the-board, top-to-bottom cut in both corporate and personal income taxes, to become effective January 1, 1963, may result in renewed confidence in the economy, and further improve the outlook which we have presented here.

Total economic activity, or gross national product, was at an annual rate of \$552 billion in this year's second quarter. That was a \$3.7 billion increase over the first quarter annual rate, and a \$9.8 billion increase over 1961's fourth quarter rate. The total for 1962 is now estimated at \$557 billion, or \$35.7 billion over the 1961 total. Currently bolstering this year's outlook for the second half of the year is a return to inventory build-up, increased capital spending, record expenditures for new construction, and increased spending by consumers, Federal, state and local governments. When combined, these factors should easily push GNP to a new record of about \$567 billion in this year's fourth quarter. In the year ahead, 1963, GNP should cross the \$600 billion mark during the third quarter, possibly earlier.

Industrial production in July stood at a record 119% of the 1957 average, up from 118% in May and

June. The index in July 1961, one year earlier, was 112%. The July increases were widespread across the various industries, but much of the credit went to the auto industry. Steel production actually edged down to 77% of the 1957 average in July, from 78% in June, but now shows signs of a slow pick-up in the months ahead.

Employment is at an all-time high, registering 69.6 million in July, up over a million from July a year earlier. However, unemployment still remains high, too, at 4 million, or 5.3% of the total labor force.

Personal income rose to a seasonally adjusted record annual rate of \$442 billion in July, up \$1.3 billion from the June pace. Estimated personal income taxes, both Federal and state, for 1962 is \$54.7 billion, which leaves disposable personal income for 1962 at a \$387.3 billion annual rate. This would be a 6.1% increase over 1961, which further adds to the element of demand for more goods and services. Note that over the 12-year period of 1950 to 1962, Federal personal income taxes have increased 153%, while state personal income taxes have skyrocketed 235%. The personal income growth rate trend is shown in the "Personal Income" chart, while the personal income tax trend and disposable personal income trend are presented in the table on "Personal Income, Taxes, and Disposable Personal Income."

Personal savings during the first quarter of this year were at a sea-

sonally adjusted annual rate of \$26.2 billion, a record. This was about 6.7% of the estimated \$387.3 billion disposable personal income for 1962, which is approximately normal for the annual average over the past decade.

## Consumer Spending

Consumers are now spending at an annual rate of about \$360 billion (\$352 billion in 1st quarter 1962). This is at an annual rate some \$21 billion higher than in 1961. The table on "Consumer Spending" shows the relative amounts for durable and nondurable goods, and for services. In the 12-year period from 1950 to 1962 the increases have been as follows: durable goods—47.4%; nondurable goods—60.1%; and services—127%. Total consumer credit has surged ahead 164% since 1950, as shown in the table on "Consumer Credit." New car purchases, now running at an annual rate of nearly seven million, have boosted installment credit over the past several months.

## Inflation

The value of the dollar has been eroding continuously, as can be seen by the chart, "Purchasing Power of the Dollar." Using 1947-49 as a base period, the 1960 dollar was worth 79.1 cents, and the 1940 dollar was worth \$1.67. Stated differently, the 1960 dollar, appraised in 1940 dollars, was worth only 47.



ents. The decline in the value of the dollar has been consistent, from year to year, and still continues, although at a slower rate over the last four or five years (see "Cost-of-Living" chart).

In general, prices have stabilized to a considerable extent over the past few years. Using the BLS Index on Wholesale Prices, prices in 1962 were up 19.1% from the 1947-49 base period. Price stability has been promoted through efficient production, and with ample excess production capacity in most industries, and has been achieved notwithstanding the continuing increases in labor costs. Over-all inflation still remains a threat, and has not been eliminated. But its growth has been retarded over the last three or four years.

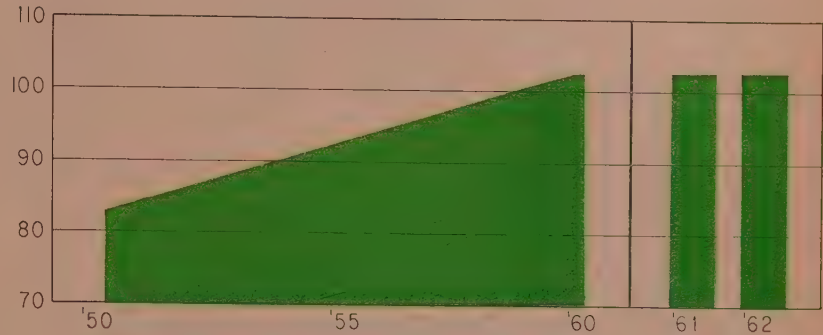
### Government Spending

America's national (public) debt reached and passed \$300 billion for the first time in its history on August 15, 1962, according to a report by the U. S. Treasury Department. What does this mean to the average citizen? First of all, it means that the debt amounts to \$1600 for each man, woman and child. But more importantly, it means that taxpayers annually fork up in excess of \$9 billion for interest, or over \$48 per man, woman and child. Each year the Treasury must pay off more than a quarter of its \$300 billion debt, either by putting up cash or by trading new securities for old. Since the Government continues to spend more each year than it takes in (run up deficit), the money to meet its annual obligations is raised chiefly by borrowing, an act that also helps to push up borrowing costs for private borrowers. With the Federal budget now running at approximately \$93 billion (for fiscal 1963), the estimated \$9.4 billion interest bill requires one dollar out of every ten being spent by the Government. The growth of Government spending, both total and broken down by major classes of spending, is shown in an accompanying table.

Growth in Federal spending is, of course, the key to President Kennedy's urge to get the economy "moving ahead." When the economy expands, tax income increases, and more money can be spent by the Federal government on its various projects.

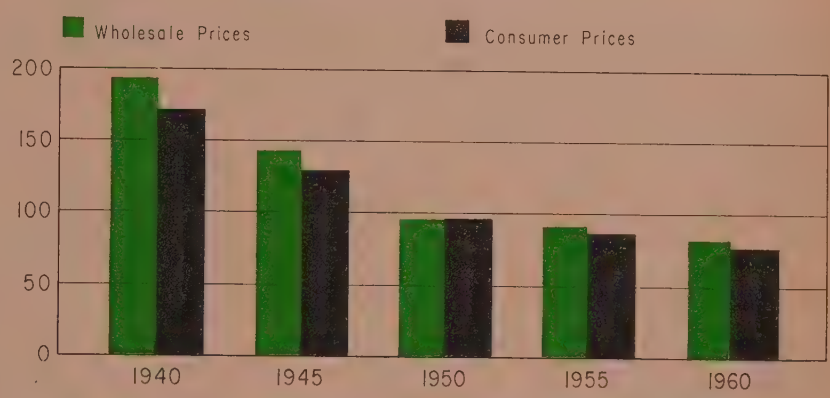
## GROWING INFLATION CONTINUES DOLLAR DEVALUATION

**COST-OF-LIVING**  
(Consumer Price Index: 1957-59 = 100)



\*Monthly, as of June 1962

**PURCHASING POWER OF THE DOLLAR**  
(Based on 1947-49 = 100)\*



\*Obtained by computing reciprocals of price indexes, expressed as percentages with average of base period 1947-49=100. Source: Dept. of Commerce, OBE.

### WHOLESALE PRICES (All Commodities)

| Year        | BLS Index* |
|-------------|------------|
| 1950.....   | 103.1      |
| 1955.....   | 110.7      |
| 1960.....   | 119.6      |
| 1961.....   | 119.2      |
| 1962**..... | 119.1      |

\* Bureau of Labor Statistics Index. 1947-49 = 100.

\*\* As of May 1962.

Note: New indexes based on 1957-59 = 100 shows May 1962 as 100.2.

| Year      | BLS Index* |
|-----------|------------|
| 1960..... | 100.7      |
| 1961..... | 100.3      |

#### Monthly

|               |       |
|---------------|-------|
| 1961—Apr..... | 100.5 |
| —July.....    | 99.9  |
| —Oct.....     | 100.0 |
| 1962—Jan..... | 100.8 |
| —Apr.....     | 100.4 |

\* New series, BLS Index based on 1957-59 = 100.

Source: Dept. of Labor, BLS.



# GOVERNMENT SPENDING OUTPACES REVENUE

FEDERAL GOVERNMENT SPENDING AND PUBLIC DEBT  
(Billions of Dollars)

| Fiscal Year | Major National Security | Veterans' Services and Benefits | Agriculture and Agricultural Resources | Interest | All other | Total | Public Dept. |
|-------------|-------------------------|---------------------------------|----------------------------------------|----------|-----------|-------|--------------|
| 1954.....   | 46.9                    | 4.3                             | 2.6                                    | 6.5      | 7.2       | 67.5  | 271.3        |
| 1955.....   | 40.6                    | 4.5                             | 4.4                                    | 6.4      | 8.5       | 64.4  | 274.4        |
| 1958.....   | 44.1                    | 5.0                             | 4.4                                    | 7.7      | 10.1      | 71.4  | 276.3        |
| 1959.....   | 46.4                    | 5.2                             | 6.5                                    | 7.7      | 14.5      | 80.3  | 284.7        |
| 1960.....   | 45.6                    | 5.0                             | 4.8                                    | 9.3      | 11.7      | 76.5  | 286.3        |
| 1961.....   | 47.4                    | 5.3                             | 5.2                                    | 9.1      | 14.5      | 81.5  | 288.8        |

Source: Federal Reserve Bulletin.

EMPLOYEES IN GOVERNMENT  
(Annual Average-in Thousands)

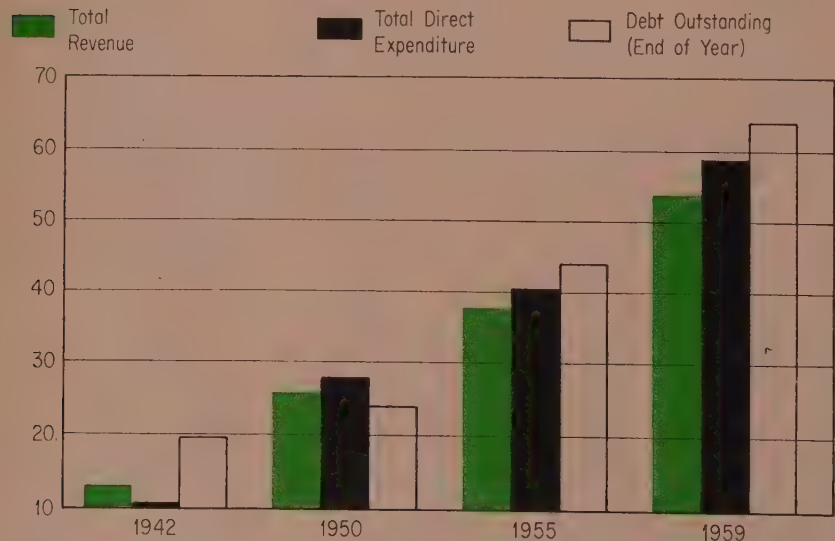
| FEDERAL GOVERNMENT |                 |           |             |          |
|--------------------|-----------------|-----------|-------------|----------|
| Year               | Total Employees | Executive | Legislative | Judicial |
| 1960.....          | 2,270           | 2,242.6   | 22.6        | 4.9      |
| 1961.....          | 2,279           | 2,250.9   | 23.3        | 5.1      |
| 1962 (March).....  | 2,294           | 2,264.8   | 23.5        | 5.4      |

STATE AND LOCAL GOVERNMENT  
(Annual Average-in Thousands)

| Year              | State   | Local   | Education | Other (S & L) | Total |
|-------------------|---------|---------|-----------|---------------|-------|
| 1960.....         | 1,592.7 | 4,657.0 | 2,983.3   | 3,266.4       | 6,250 |
| 1961.....         | 1,663.6 | 4,884.5 | 3,175.4   | 3,373.9       | 6,548 |
| 1962 (March)..... | 1,710.9 | 5,116.7 | 3,456.9   | 3,370.7       | 6,828 |

Source: Dept. of Labor, BLS.

STATE AND LOCAL GOVERNMENT SPENDING  
(Billions of Dollars)



Source: Dept. of Commerce, Census Bureau

Further examples of the burgeoning growth of government spending are shown in the table "Employees in Government," and in the chart "State and Local Government Income and Spending."

Notwithstanding a request from President Kennedy last October for Cabinet officers and Federal agency heads to keep the number of Government employees to a minimum "consistent with getting the job done," the 1962 fiscal year-end Federal job total in June was 77,350 more employees than the Government had in June 1961. Also, the Federal payroll on June 30 was in excess of \$14 billion, an all-time record.

Revenues collected by state and local governments increased 213% between 1942 and 1959, while total direct expenditures by these same governments increased 337%.



# THE ELECTRICAL INDUSTRY

**T**HE electrical industry has been growing at a slightly faster pace than the national economy as a whole. Thus, with the national economy at a record high, the electrical industry is also at its highest point on record. For the year 1962, it is estimated that total dollar volume for all branches of the electrical industry will exceed \$43 billion, or about 7.7% of total economic activity (GNP).

Here are some highlights of electrical growth in 1962. Electric power output will be about 860 billion kwhr, up 7.5% from 1961. Electrical construction work will total about \$5.7 billion, up 6% from 1961. Lighting equipment dollar volume will exceed \$600 million, up about 3.5% from last year. Electric comfort heating sales will climb about 10% over 1961 volume. Shipments of electrical appliances are expected to increase about 6%.

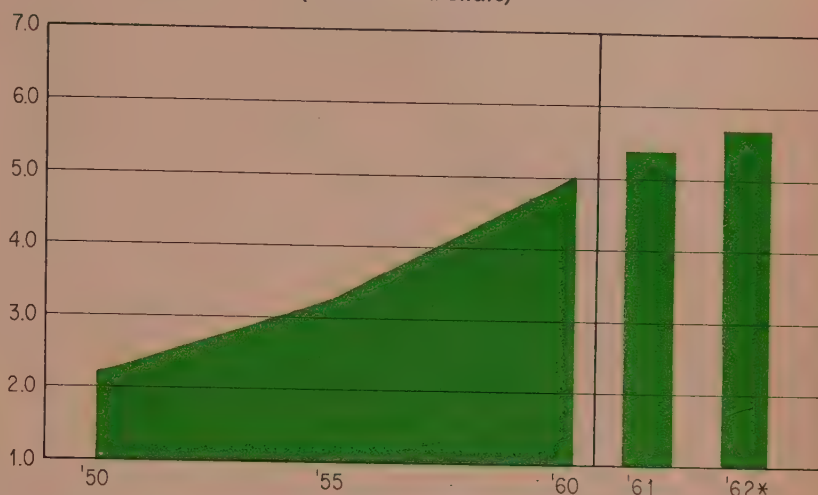
In a recent survey of 1962 second quarter profits, conducted by Dow Jones and Company, Inc., 23 electrical equipment-electronics firms reported a combined 25.2% increase in earnings over the comparable quarter in 1961. This compared with an average 15.5% increase in profits for 478 firms surveyed, which included a typical cross-section of all industry, with 37 different industries represented. Only six of the industries showed higher combined increases in earnings than did the electrical industries represented in the survey.

Electrical industry market growth patterns, like those of most other industries, are, of course, closely linked with national economy growth patterns. For maximum growth opportunity, especially for certain of the electrical markets, a healthy general business climate is desirable, and a stable, sound and growing national economy is a necessity.

As will be recalled, the national economy drifted through 1960 at a plateau of \$500 billion GNP, not varying over \$5 billion (annual rate) throughout the entire year. The annual GNP for 1959 was \$482.8 billion, so the 1960 level was a plateau approximately \$15 to \$18 billion above the 1959 annual level.

Beginning with the first quarter of 1961, as the Kennedy Administration came into office, the GNP declined \$3.7 billion to \$500.8 bil-

## ELECTRICAL WORK IN CONSTRUCTION (Billions of Dollars)



Source: Electrical Construction and Maintenance  
\*El. C. & M. estimate, as of mid-1962

## 1962 ELECTRICAL CONSTRUCTION (Millions of Dollars)

| Type of Construction                                | Private Funds       | Volume* |
|-----------------------------------------------------|---------------------|---------|
| Residential.....                                    | 980                 |         |
| Industrial**.....                                   | 435                 |         |
| Commercial and institutional.....                   | 1,080               |         |
| Utilities***.....                                   | 402                 |         |
| Farms.....                                          | 105                 |         |
| Other.....                                          | 12                  |         |
| <b>Total Private.....</b>                           | <b>3,014</b>        |         |
|                                                     | <b>Public Funds</b> |         |
| Residential.....                                    | 33                  |         |
| Industrial.....                                     | 70                  |         |
| Educational.....                                    | 412                 |         |
| Institutional.....                                  | 225                 |         |
| Military.....                                       | 102                 |         |
| Highway and conservation.....                       | 304                 |         |
| Other.....                                          | 30                  |         |
| <b>Total Public.....</b>                            | <b>1,176</b>        |         |
| <b>Total for new construction.....</b>              | <b>4,190</b>        |         |
| <b>Total for modernization and repairs****.....</b> | <b>1,500</b>        |         |
| <b>Total electrical construction work.....</b>      | <b>5,696</b>        |         |

\* El. C. & M. estimate as of mid-1962.

\*\* Does not include motors, controls or electrical equipment which are a part of machines or manufacturing processes.

\*\*\* Does not include electrical apparatus used in generation and distribution, nor communication equipment.

\*\*\*\* Does not include replacement lamps.

lion annual rate. The second quarter showed a healthy pickup to \$516.1 billion annual rate. Further increases were registered in the third and fourth quarters, to \$525.8 and \$542.2 billion annual rates respectively.

As 1962 figures came in, it be-

came apparent that the economy was losing some of its steam. First quarter GNP was up \$6.1 billion annual rate over 1961's fourth quarter rate. Then the second quarter annual rate was \$552 billion, for an increase of only \$3.7 billion annually. Thus the national economy



## 1962 OUTLOOK FOR NEW CONSTRUCTION

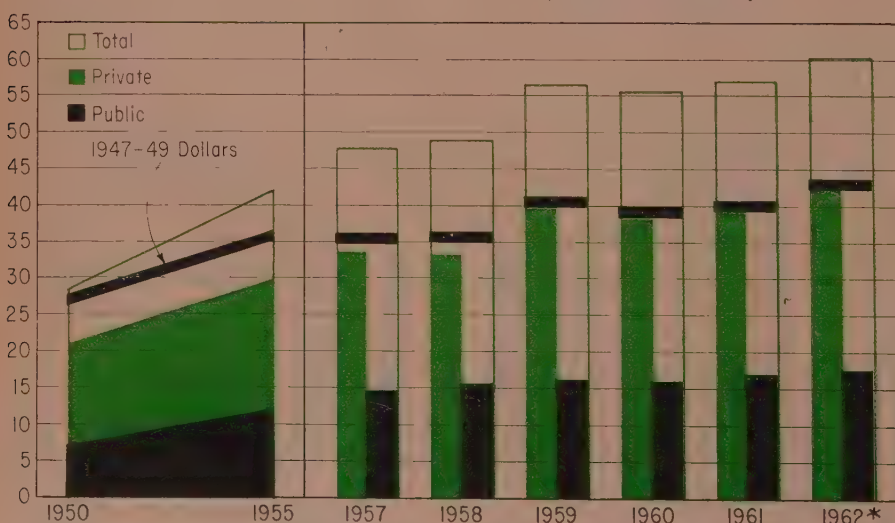
(Millions of Dollars)

| Type of Construction                      | Dollar Value   |               |                   | % Change<br>1961/1960 |
|-------------------------------------------|----------------|---------------|-------------------|-----------------------|
|                                           | Actual<br>1960 | 1961          | Estimate*<br>1962 |                       |
| <b>TOTAL NEW CONSTRUCTION</b> .....       | <b>55,556</b>  | <b>56,925</b> | <b>60,075</b>     | <b>+6</b>             |
| <b>PRIVATE CONSTRUCTION (Total)</b> ..... | <b>39,603</b>  | <b>40,009</b> | <b>42,500</b>     | <b>+6</b>             |
| Residential buildings (nonfarm).....      | 22,546         | 22,499        | 24,650            | +10                   |
| New housing units.....                    | 16,422         | 16,188        | 17,900            | +11                   |
| Additions and alterations.....            | 5,199          | 5,139         | 5,500             | +7                    |
| Nonhousekeeping.....                      | 925            | 1,172         | 1,250             | +7                    |
| Nonresidential buildings (nonfarm).....   | 10,168         | 10,754        | 11,000            | +2                    |
| Industrial.....                           | 2,851          | 2,759         | 2,600             | -6                    |
| Commercial.....                           | 4,180          | 4,663         | 4,825             | +3                    |
| Office buildings and warehouses.....      | 2,121          | 2,350         | 2,375             | +1                    |
| Stores, restaurants and garages.....      | 2,059          | 2,313         | 2,450             | +6                    |
| Other nonresidential buildings.....       | 3,137          | 3,332         | 3,575             | +7                    |
| Religious.....                            | 1,103          | 984           | 1,000             | +2                    |
| Educational.....                          | 566            | 592           | 625               | +6                    |
| Hospital and institutional.....           | 605            | 787           | 900               | +14                   |
| Social and recreational.....              | 707            | 701           | 750               | +7                    |
| Miscellaneous.....                        | 246            | 268           | 300               | +12                   |
| Farm construction.....                    | 1,285          | 1,473         | 1,500             | +2                    |
| Public utilities.....                     | 5,323          | 5,033         | 5,100             | +1                    |
| Railroad.....                             | 285            | 222           | 225               | +1                    |
| Telephone and telegraph.....              | 1,088          | 976           | 1,000             | +2                    |
| Electric light and power.....             | 2,058          | 2,050         | 2,125             | +4                    |
| Gas.....                                  | 1,767          | 1,650         | 1,500             | -9                    |
| Other public utilities.....               | 125            | 135           | 250               | +85                   |
| All other private.....                    | 281            | 250           | 250               | 0                     |
| <b>PUBLIC CONSTRUCTION (Total)</b> .....  | <b>15,953</b>  | <b>16,916</b> | <b>17,575</b>     | <b>+4</b>             |
| Residential buildings.....                | 716            | 840           | 950               | +13                   |
| Nonresidential.....                       | 4,792          | 5,132         | 5,150             | 0                     |
| Industrial.....                           | 407            | 444           | 425               | -4                    |
| Educational.....                          | 2,818          | 3,051         | 3,000             | -2                    |
| Hospital and institutional.....           | 400            | 370           | 400               | +8                    |
| Administrative and service.....           | 598            | 674           | 725               | +8                    |
| Other non residential b ilding.....       | 596            | 593           | 600               | +1                    |
| Military facilities.....                  | 1,386          | 1,368         | 1,250             | -9                    |
| Highways.....                             | 5,464          | 5,700         | 6,200             | +9                    |
| Sewer and water systems.....              | 1,487          | 1,581         | 1,725             | +9                    |
| Sewer.....                                | 882            | 914           | 1,050             | +15                   |
| Water.....                                | 605            | 667           | 675               | +1                    |
| Public service enterprises.....           | 649            | 585           | 500               | -15                   |
| Conservation and development.....         | 1,221          | 1,350         | 1,400             | +4                    |
| All other public.....                     | 238            | 360           | 400               | +11                   |

\* As of mid-1962, by BDSA, Dept. of Commerce. Source: Dept. of Commerce, BDSA.

## GROWTH OF NEW CONSTRUCTION

(Billions of Dollars)



\* Mid-1962 estimate by BDSA, Dept. of Commerce. Source: Dept. of Commerce.

New construction, a major factor in the national economy, has a consistent record of doubling about every ten years in the postwar period. Even physical growth, as measured in constant (1947-49) dollars, has been registered in most years. Outlook is for continued growth in 1962 and 1963.



As has been shown in the earlier discussion on the national economy, there are signs of continued economic strength, and further growth in the months ahead. As will be shown in the following analysis of economic indicators closely related to electrical industry markets and growth, such as new construction activity, capital expenditures, electrical utility industry expansion, etc., the outlook for the electrical industry is good, especially through 1962, and probably through most of 1963.

### Electrical Construction Work

Electrical work this year will show an increase of about 6% over 1961, and the forecast for 1963 is for an increase over this year's total of 5.3%, or approximately the same rate of increase as in 1962.

Referring to the chart at top of page 97, it can be seen that electrical work more than doubled in the decade of 1950-1960 (actual increase was 128%). During this same period, new construction activity on an annual basis increased 45%, in current dollars, from \$26.6 billion in 1950 to \$38.7 billion in 1960, not including modernization work. Part of the higher increase in electrical work resulted from high modernization activity, but mostly the increase resulted from technological advancements and continuing increases in electrical standards.

The forecast for electrical construction work in 1962 is shown in the table on page 97. Note that over one-fourth of the total volume is indicated for modernization and repair work, or \$1.5 billion volume out of \$5.7 billion volume. Also, it is interesting to note that construction activity paid for with private funds accounts for 53% of the total, while public fund construction accounts for 20.6% of the total. Further analysis of this table will indicate the relative size of markets for electrical work involved in the various types of construction work.

### New Construction Activity

Electrical construction work dollar volume is dependent wholly upon two basic activities—new construction, and modernization and repair. Statistical data are made available promptly on new construction activity, which currently accounts for about 73½% of electrical construction work, but is not generally available on modernization

## BACKLOG OF PROPOSED ENGINEERING CONSTRUCTION

(Thousands of Dollars)

| Type of Construction                                                   | Backlog*           | % of Total   |
|------------------------------------------------------------------------|--------------------|--------------|
| <b>Private Projects</b>                                                |                    |              |
| Bridges.....                                                           | 121,997            | 0.1          |
| Industrial buildings.....                                              | 18,030,906         | 14.2         |
| Commercial buildings.....                                              | 29,458,602         | 23.3         |
| Unclassified.....                                                      | 10,684,345         | 8.4          |
| <b>Total private projects.....</b>                                     | <b>58,295,850</b>  | <b>46.0</b>  |
| <b>Public Works Projects</b>                                           |                    |              |
| Waterworks.....                                                        | 3,089,961          | 2.4          |
| Sewerage.....                                                          | 4,437,971          | 3.5          |
| Bridges.....                                                           | 3,216,756          | 2.5          |
| Earthwork, irrigation, drainage.....                                   | 11,961,583         | 9.5          |
| Streets and roads.....                                                 | 13,183,595         | 10.4         |
| Buildings.....                                                         | 22,987,205         | 18.1         |
| Unclassified.....                                                      | 9,654,133          | 7.6          |
| <b>Total public works projects.....</b>                                | <b>68,531,204</b>  | <b>54.0</b>  |
| <b>Total backlog (private and public).....</b>                         | <b>126,827,054</b> | <b>100.0</b> |
| <b>Federal Government work, included in public works projects.....</b> | <b>13,873,461</b>  | <b>10.9</b>  |

\* For United States, including Alaska and Hawaii, as of June 30, 1962.

Source: Engineering News-Record.

## NEW CONSTRUCTION IN AN EXPANDING ECONOMY

(Billions of 1960 Dollars)

| Type of Construction                   | 1950*       | 1955*       | 1960        | 1975**       | 2000**       |
|----------------------------------------|-------------|-------------|-------------|--------------|--------------|
| <b>Total new construction.....</b>     | <b>42.7</b> | <b>52.9</b> | <b>55.6</b> | <b>107.4</b> | <b>218.7</b> |
| <b>Total private construction.....</b> | <b>33.1</b> | <b>39.6</b> | <b>39.6</b> | <b>75.5</b>  | <b>147.3</b> |
| Residential (nonfarm)....              | 20.2        | 23.3        | 22.5        | 45.5         | 74.2         |
| Commercial/industrial....              | 3.4         | 6.7         | 7.0         | 11.9         | 29.4         |
| Public utilities.....                  | 5.2         | 5.4         | 5.3         | 9.2          | 22.8         |
| All other private.....                 | 4.3         | 4.2         | 4.8         | 8.9          | 20.9         |
| <b>Total public construction..</b>     | <b>9.6</b>  | <b>13.3</b> | <b>16.0</b> | <b>31.9</b>  | <b>71.4</b>  |
| Educational.....                       | 1.6         | 2.9         | 2.8         | 5.5          | 9.2          |
| Highways.....                          | 2.6         | 4.0         | 5.5         | 12.1         | 27.5         |
| All other public.....                  | 5.4         | 6.4         | 7.7         | 14.3         | 34.7         |

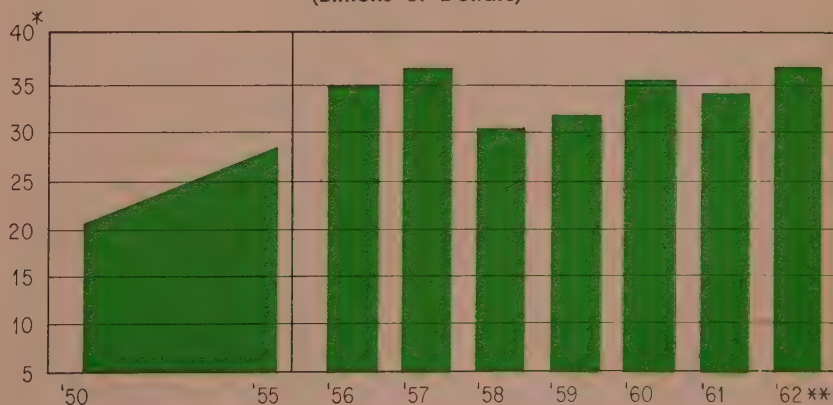
\* Actual values in current dollars adjusted to 1960 dollars.

\*\* Mid-1961 estimate by BDSA, Dept. of Commerce.

## CAPITAL SPENDING BY BUSINESS

(For New Plant and Equipment)

(Billions of Dollars)\*



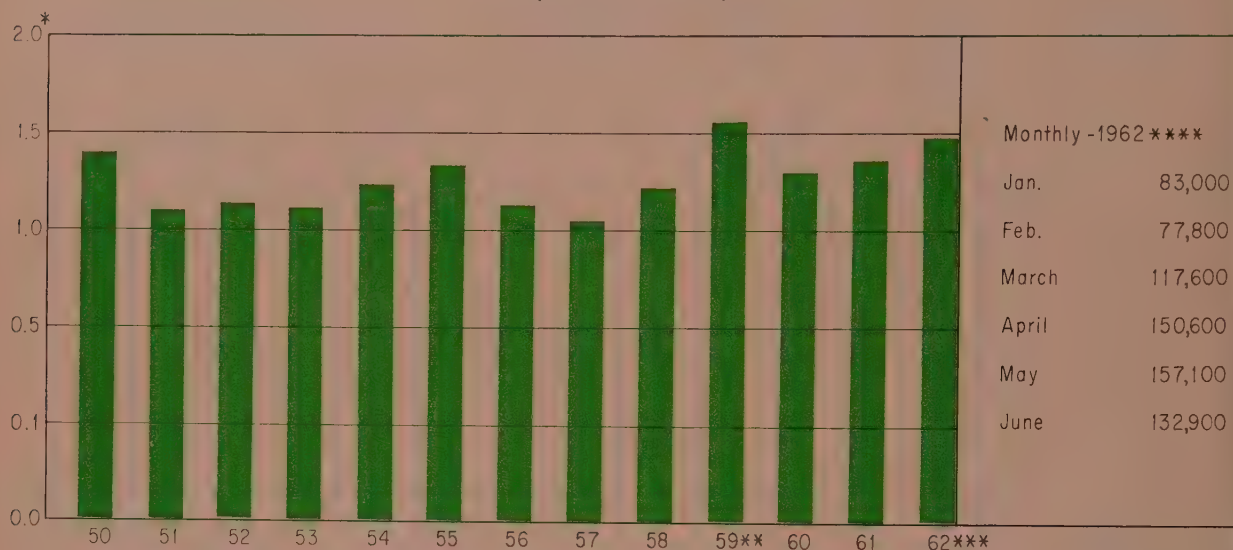
\* In current dollars

\*\* Anticipated by business, as of May 1962

Source: Dept. of Commerce and Securities and Exchange Commission



## HOME BUILDING ACTIVITY

NEW HOUSING STARTS  
(Millions of Units)

\* Total starts, including private and public. \*\* New statistical series, includes Alaska and Hawaii. Starts based on old series, were 1,378,500.

\*\*\* Dept. of Commerce estimate, mid-1962. \*\*\*\* Unadjusted monthly total. Source: Dept. of Commerce.

and repair activity for more than a year later.

New construction this year will show a 6% increase over 1961's record \$56.9 billion total, and should pass the \$60-billion mark, according to a mid-year estimate by the Building Materials and Construction Industries Division, Business and Defense Services Administration, Department of Commerce.

Construction spending using private funds is expected to exceed \$42 billion this year, and should account for the major part of the total dollar gain of \$3.2 billion anticipated for all construction. Public construction spending, although estimated to reach a record level of \$17.6 billion this year, should show a somewhat lower rate of increase this year than in 1961—4% as against 6% last year.

A detailed breakdown of the 1962 new-construction dollar volume for various types of construction is given in the table "1962 Outlook for New Construction."

In this latest review of the outlook for 1962 new construction, outlays for new private housing units and highways are expected to exceed previous forecasts with strong

increases of 11% and 9% respectively. Outlays for private industrial and public education structures are expected to decline below 1961 levels, reversing an upward trend which had seemed indicated previously.

**Industrial Construction Down**

It may be noted that the types of construction which are providing strength to this year's growth outlook are housing and highways, which carry a small potential for electrical construction work, while industrial and educational construction, which normally carry a high potential for electrical construction work is on the decline. It is assumed that this trend will carry over into 1963, and thus curtail the 1963 dollar volume potential for electrical construction work to some extent.

Motel construction expenditures show some signs of slackening from the very rapid rate of gain in the last few years. Nevertheless, the nonhousekeeping category of construction, which is influenced largely by motel building, is expected to exceed the 1961 level by

approximately seven percent.

All types of private nonresidential buildings, except private industrial construction, are expected to exceed 1961 levels, with gains ranging from 1% for office buildings, 14% for hospitals and institutional buildings.

The downtrend in 1962 industrial construction is expected to reduce the level of spending on new plants to \$2.6 billion, down 6% from the 1961 total. Industrial construction spending reflects a number of factors, such as a relatively good capacity situation in relation to current output, emphasis on modernizing existing plants with new equipment, and the design of structures to permit better space utilization which yield greater output potentials within smaller areas of constructed facilities.

Work on office building projects under way in 1961 in New York City has contributed strongly to the maintenance of high levels for the office building and warehouse type of construction. The growing number of new building projects developing this year outside of New York City are smaller in size, thus tending to limit the relative gain



## GROWTH OF RESIDENTIAL CONSTRUCTION

(Millions of Dollars)

| Year         | Volume<br>New Dwelling Units Only | Total* |
|--------------|-----------------------------------|--------|
| 1950.....    | 11,870                            | 14,445 |
| 1951.....    | 10,444                            | 13,124 |
| 1952.....    | 10,524                            | 13,496 |
| 1953.....    | 11,111                            | 14,333 |
| 1954.....    | 12,406                            | 15,715 |
| 1955.....    | 15,253                            | 16,858 |
| 1956.....    | 13,802                            | 15,631 |
| 1957.....    | 12,670                            | 17,081 |
| 1958.....    | 14,398                            | 18,893 |
| 1959**.....  | 20,195                            | 25,431 |
| 1960.....    | 17,181                            | 22,782 |
| 1961.....    | 17,083                            | 23,408 |
| 1962***..... | 18,850                            | 25,600 |

\* Includes new dwelling units (private and public), additions and alterations, and nonhousekeeping.

\*\* New statistical series, includes Alaska and Hawaii.

\*\*\* Dept. of Commerce estimate, as of mid-1962.

Source: Dept. of Commerce, BDSA.

Proposed Engineering Construction," which in June of this year showed an increase of \$1.72 billion over June of 1961 (see table).

All of the above considerations point to an optimistic outlook short-range, or through 1963, for new construction activity, but does not indicate that construction will reach boom proportions. Instead, it would seem that sound, conservative growth in construction is assured for the next 15 months, provided there is no spectacular change in the national economy.

### Long-Range Outlook

For a look at new construction on a long-range basis, the Department of Commerce study, made in 1961 for the U. S. Study Commission, Southeast River Basin, is used. Covering the period of 1950 to 2000, and expressed in constant (1960) dollars, the results of this study are shown in the table "New Construction in an Expanding Economy." Summarized briefly, this study indicates that new construction will approximately quadruple over the next 40 years, by the year 2000. The study also indicates that 1960 construction dollar volume will approximately double by 1975, then double again over the 25-year period from 1975 to 2000. Growth rates for individual types of construction over this four-decade period are also shown in the table.

In the analysis of new construction on a year-to-year basis, it is common practice to use current prices for each year's volume. These prices do not reflect true new construction growth, since current prices inject any inflation, or dollar devaluation which may occur. In order to determine the physical volume of new construction, it is necessary to express volume in a constant dollar. This has been done in the chart, titled "Growth of New Construction," for the 12-year period of 1950 to 1962, with physical volume expressed in constant (1947-49 = 100) dollars. As will be noted in this chart, new construction physical volume made a sizable jump in 1959, then declined in 1960, and is only exceeding the 1959 volume as of 1962. The same chart also shows construction

in over-all spending for office buildings in 1962 as compared to 1961.

Suburban growth continues to be the dominant factor in determining present high expenditure levels for shopping centers, schools, hospitals and recreational facilities paid for with private funds.

In the farm classification, slightly rising incomes in 1962 are tending to maintain construction levels. The decreasing number of farms, however, is shifting the emphasis to construction of nonresidential facilities.

Public utilities construction spending in 1962 will show only a small over-all increase. New large oil pipeline spending, modest gains for electric light and power, and telephone facilities are expected to more than offset lower construction spending for gas utilities construction.

Construction spending with public funds is expected to increase about 4% in 1962 over 1961, to \$17.6 billion. An increase of \$500 million for highway spending this year will boost this type of construction to a record \$6.2 billion. Military facilities expenditures are tapering off somewhat, as they are

heavily influenced by the fulfillment of requirements in the missile base construction program. Educational construction will drop slightly this year from 1961 levels, as educational construction programs are reviewed. Because of the continued shifting of population to the suburbs, and the shift in needs as between elementary and secondary school levels, many communities are deferring programs while they take a close look at the rapidly changing school enrollment situation.

The Department of Commerce forecast, as outlined above, is based on new construction work "put in place." The F. W. Dodge Corporation collects statistics on "contracts let," and similar trends are indicated by the latest Dodge statistics. Specifically, in August Dodge reported "The performance (of construction contracts) has been nothing short of phenomenal (for the first five months of 1962), with all major sectors of new construction contributing to a widespread advance over the comparable months in 1961."

Still another yardstick of new construction is *Engineering News-Record's* continuing "Backlog of



## 1962 LIGHTING EQUIPMENT DOLLAR VOLUME

Used for General Lighting Purposes\*  
(Thousands of Dollars)

| Type of Construction Where Used             | Value**          |
|---------------------------------------------|------------------|
| <b>TOTAL NEW CONSTRUCTION</b> .....         | <b>\$541,291</b> |
| <b>PRIVATE CONSTRUCTION</b> .....           | <b>\$392,649</b> |
| Residential building (nonfarm).....         | 142,970          |
| Nonresidential building (nonfarm).....      | 217,199          |
| Industrial.....                             | 53,508           |
| Offices, warehouses and loft buildings..... | 59,375           |
| Stores, restaurants and garages.....        | 52,350           |
| Other residential buildings.....            | 51,966           |
| Religious.....                              | 18,000           |
| Educational.....                            | 11,016           |
| Hospital and institutional.....             | 15,750           |
| Social and recreational.....                | 4,950            |
| Miscellaneous.....                          | 2,250            |
| Farm construction.....                      | 3,413            |
| Public utilities.....                       | 28,275           |
| Telephone and telegraph.....                | 12,900           |
| Other public utilities.....                 | 15,375           |
| All other private.....                      | 792              |
| <b>PUBLIC CONSTRUCTION</b> .....            | <b>\$148,642</b> |
| Residential.....                            | 3,325            |
| Nonresidential building.....                | 85,927           |
| Industrial.....                             | 5,364            |
| Educational.....                            | 51,450           |
| Hospital and institutional.....             | 6,860            |
| Administrative and service buildings.....   | 15,503           |
| Other nonresidential building.....          | 6,750            |
| Military facilities.....                    | 4,500            |
| Sewer and water systems.....                | 1,290            |
| Public service enterprises.....             | 2,000            |
| Conservation and development.....           | 700              |
| Highways (includes street lighting).....    | 49,700           |
| All other public.....                       | 1,200            |
| <b>MODERNIZATION (relighting)</b> .....     | <b>60,000</b>    |
| <b>TOTAL LIGHTING</b> .....                 | <b>601,291</b>   |

\* Does not include searchlights, automotive, aircraft or railway coach lighting, residential portable lamps, and similar types of lighting equipment not associated with building construction.

\*\* Based on manufacturers' selling prices. El. C. & M. estimate, mid-1962, based on Dept. of Commerce forecast for 1962 new construction at mid-1962.

growth over the same period, expressed in current prices.

Another strong growth factor which is also improving the market for electrical construction work and electrical products is that of spending on new plant and equipment. Data on this factor are given in the chart on "Capital Spending By Business." Note that the previous record of expenditures was

made in 1957, at \$37.0 billion, and that spending in 1958 dropped 17½% from that record. An increase is expected this year of about 8% from 1961's \$34.4 billion. Under Administration sponsorship, Congress has under consideration a tax revision bill which would provide 7% investment credit, designed to spur capital spending. Currently, the outlook for capital

spending next year is for a continuation at about the same pace for this year. Businessmen declare that a more favorable attitude toward business by the Administration and by the Federal government would help to keep capital spending going on its own.

**Residential Construction**

The most active year in residential construction in the postwar era was 1950, when new business starts totaled almost 1.4 million units. The dollar value of this construction was slightly under \$12 billion. Since 1950, housing starts have varied from just above a million units to 1.3 million units annually. In 1959, a new statistical series was begun, which also includes Alaska and Hawaii, and new starts peaked at 1,553.5 thousand units that year. The two years since have shown declines from the 1959 record.

Department of Commerce has forecast a total of 1,475 thousand housing starts for 1962, of which 1,425 thousands units will be privately financed, and 50 thousand units will be publicly financed. Housing dollar volume forecast for this year will total about \$17.9 billion, or nearly 50% more than in 1950. This higher dollar volume in 1962 represents price increases and indicates that larger and better houses are now also being built.

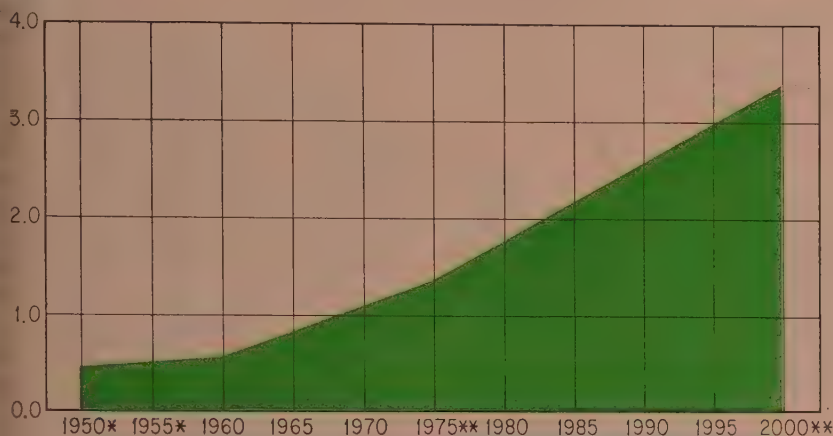
Residential construction is expected to carry over at its present high level into 1963, in view of the general adequacy of mortgage funds at current interest rates, and a continuing demand for new homes in most parts of the nation.

The growth of residential construction over the past 12 years is outlined in the chart on "New Housing Starts," and the table showing "Growth of Residential Construction." In the table, dollar volume (in current prices) for "new dwelling units only" is shown in the first column, and dollar volume for all types of nonfarm residential buildings, including additions and alterations, and non-housekeeping (dormitories, motels, hotel, etc.) is given in the second column. A check of "Residential buildings" and the three subheads under it, in the table "1962 Outlook For New Construction" will give the values for 1960 and 1961, and the forecast for 1962.



## LIGHTING EQUIPMENT DOLLAR VOLUME 1950-2000

(Used for General Lighting Purposes on New Construction Only)  
(Billions of 1960 Dollars)



\* Volume in current prices adjusted to 1960 dollars.

\*\* El. C. & M. estimate, based on forecast for new construction dollar volume by BDSA, Dept. of Commerce, as of mid-1961.

### The Lighting Industry

The quantity of lighting equipment which will be sold and installed this year is estimated at slightly more than \$600 million (see table, "1962 Lighting Equipment Dollar Volume"). This is an increase over 1961 of only 3.5%, yet new construction is expected to increase about 6%. This difference in percentage increase is caused by the "mix" of types of construction, and variations in growth relationships from year-to-year. For example, residential building in 1962 will show an increase of 10% over

1961, while industrial construction is expected to decline about 6%, and educational construction may dip about 2%. From the standpoint of both electrical construction work, and lighting equipment sales, residential construction carries only a low percentage of market potential in relation to the building dollar volume. On the other hand, industrial and school construction both involve a relatively high percentage rate for electrical work and lighting equipment, in relation to total construction costs. Thus the healthy increase in residential

construction adds only a small increase in lighting equipment dollar volume, while the declines in industrial and school construction dollar volume result in a sizable decline in lighting equipment dollar volume.

### Lighting Standards Up

Lighting standards have been increasing steadily in the postwar years, and received a strong boost in 1958 when the Illuminating Engineering Society approved and adopted a new set of lighting levels for all visual tasks, which were considerably higher than the previous official IES lighting level recommendations. Industry has been recommending and installing these higher lighting levels wherever possible; however, many lighting installations continue to go in now which are still below the 1958 IES recommended practices. There are three types of construction, particularly, where current general lighting practice is not equal to the 1958 IES recommendations. These are: 1) offices, especially speculative type office buildings; 2) schools; and 3) stores. On the other hand, industrial plants generally install lighting which meets, and in many cases exceeds, IES recommended levels. Under the impetus of the Medallion Home program, much better lighting is now being installed in homes than was true only three or four years ago. However, even the improved lighting going into Medallion Homes is still far below the type and quality of lighting which people need to live with comfortably in their homes.

The seven big markets for lighting today are: residential, industrial, offices, stores, schools, streets and highways, and outdoor flood-lighting and area lighting.

The Department of Commerce's long-range forecast for new construction, from 1960 to 2000, has been used as a basis for a long-range prediction on lighting equipment sales. This forecast is given in the chart on "Lighting Equipment Dollar Volume—1950 to 2000." While the forecast for new construction is for a quadrupled market by the year 2000, the forecast on lighting equipment volume is that it will be on an annual rate by the year 2000 approximately six times as great as in 1960.

## DOMESTIC SALES OF ELECTRIC LIGHT SOURCES

Used for General Lighting  
(Thousands of Dollars)

Dollar Value\*

| Year      | Incandescent | Fluorescent | Mercury  | Total   |
|-----------|--------------|-------------|----------|---------|
| 1950..... | 110,703      | 53,168      | 4,659**  | 168,530 |
| 1955..... | 137,031      | 66,969      | 4,805    | 208,805 |
| 1960..... | 196,524      | 109,653     | 13,804** | 319,981 |
| 1961..... | 200,317      | 111,418     | 12,953   | 324,688 |
| 1962***   | 57,945       | 30,357      | 3,433    | 91,735  |

\* Value of lamps shipped by manufacturers, at manufacturers' selling prices.

\*\* For 1950 and 1960 includes sodium, photo-chemical, and other miscellaneous electric discharge lamps. Data not available for mercury lamps separately.

\*\*\* Shipments by manufacturers for 1st quarter only, not adjusted for seasonal variations.

Source: Census Bureau, Dept. of Commerce.



Electric lamps are sold not only for new lighting installations, but also for replacement in the millions of old lighting installations. Some idea of the growth of sales of electric lamps, in dollar volume, is given in the table "Domestic Sales of Electric Light Sources." In 1961, the total market was divided among the three major types of lamps, as follows: incandescent—62.6%; fluorescent—34.4%; and mercury—4.0%. Incandescent lamp sales continue to outpace fluorescent lamp sales, even though the fluorescent lamps are nearly three times the electric power capacity of the continued popularity of the incandescent lamp is that it is still the popular light source for home lighting. Mercury lamp sales are on the increase, and spectacular growth for this lamp is expected over the next few years.

Electric Utility Industry

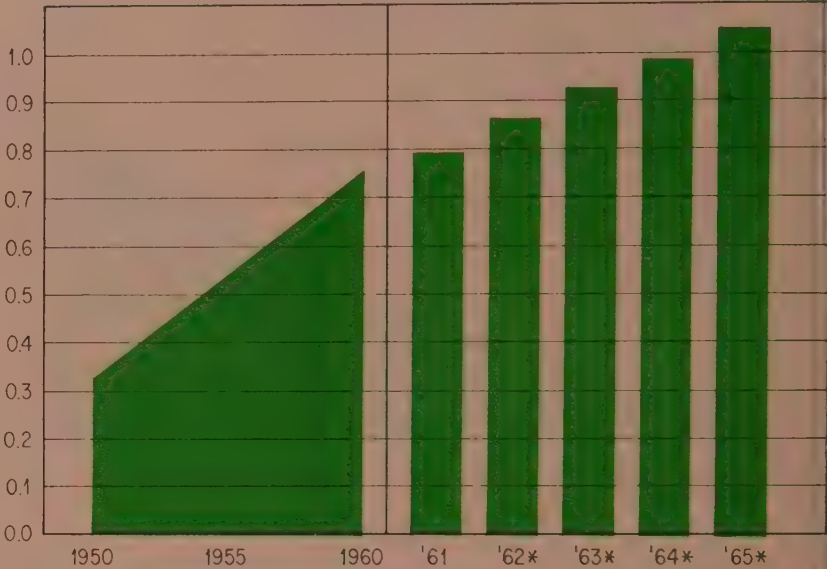
Electric power is the basis for any modern industrial society. It is one of the major factors that has made it possible for America to lead the world in the production of goods, and to enjoy the world's highest standard of living.

The United States has three times the electric power capacity of its next closest rival, Soviet Russia, and more power than the next five countries of the world combined. With only about 6% of the world's population, this country accounts for about 40% of the world's electric energy production. Power facilities currently represent an investment of over \$50 billion, for investor-owned companies only which accounts for approximately 80% of our total power facilities.

New plant and equipment spending in the electric utility field over the past eight years has averaged about \$3.2 billion annually. Installed capacity by the end of this year will total about 200 million kilowatts, and present plans call for increasing this capacity to 232 million kilowatts by the end of 1965 (see chart "Electric Power Generating Capability in U. S."). Annual output of electric energy in 1962 is forecast at 867 billion kwhr, and is increasing about 7% per year on the average.

In the table "Total Electric Energy Sales in U. S.," the growth

ELECTRIC POWER OUTPUT IN U.S.  
(Annual output in Trillions of Kwhr)



\* Forecasts by Electric Power Survey Committee of Edison Electric Institute, as of April 1962  
Source: Federal Power Commission and Edison Electric Institute

TOTAL ELECTRIC ENERGY SALES IN U. S.

| Year      | Total Kwhr* | Total Customers** | Total Revenues*** | Average Revenue Per Kwhr**** |
|-----------|-------------|-------------------|-------------------|------------------------------|
| 1950..... | 280.5       | 45.0              | \$5,086           | 1.81¢                        |
| 1955..... | 480.9       | 52.6              | 8,020             | 1.67                         |
| 1960..... | 683.2       | 58.9              | 11,516            | 1.69                         |
| 1961..... | 720.7       | 60.1              | 12,169            | 1.69                         |

\* Billions of kwhr.  
\*\* Millions of ultimate customers.  
\*\*\* Millions of Dollars.  
\*\*\*\* Cents per kwhr.

Source: Edison Electric Institute.

ELECTRIC ENERGY FOR RESIDENTIAL CUSTOMERS

| Year      | Total Energy Sales* | Average Kwhr per Customer** | Average Annual Bill/Cust.*** | Average Cost per Kwhr**** |
|-----------|---------------------|-----------------------------|------------------------------|---------------------------|
| 1950..... | 70.1                | 1,845                       | \$53.14                      | 2.88¢                     |
| 1955..... | 125.4               | 2,773                       | 73.48                        | 2.65                      |
| 1960..... | 195.6               | 3,851                       | 95.12                        | 2.47                      |
| 1961..... | 208.2               | 4,016                       | 98.39                        | 2.45                      |

Note: Data for 1960 and 1961 excludes Alaska and Hawaii.

\* Billions of kwhr.  
\*\* Kwhr per year.  
\*\*\* Average annual cost in dollars.  
\*\*\*\* Average unit (kwhr) cost in cents.

Source: Edison Electric Institute.



electric power customers, electric energy sales, and electric energy revenues can be seen for the period of 1950 to 1961. Over this period, the annual revenue per kwhr decreased from 1.81 cents to 1.69 cents, or 6.6%.

One of the important customers of electric energy is the residential user of electric power. Total electric energy sales over the 11-year period from 1950 to 1961 increased about 97%, or over 8% annually, on average. The use of electric energy per customer during this period increased from 1845 to 4016 kwhr annually. The average cost per kwhr to residential customers decreased, from 2.88 cents per kwhr in 1950 to 2.45 cents per kwhr in 1961.

America's demand for electric power continues to increase, year after year. The electric utilities companies have done an excellent job of planning the needed capacity, and having it installed and available when and where the customers want it.

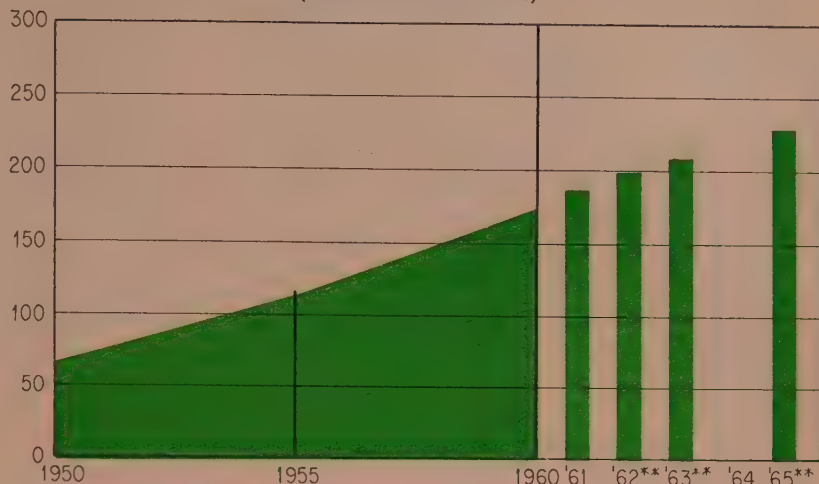
### Electric Heating

There are currently 1,200,000 electrically heated homes in the United States, according to the National Electrical Manufacturers Association. By the end of this year, the total is expected to be 1.5 million; 2.5 million by 1965; and by 1970 about half of all new homes will be electrically heated, NEMA predicts. The installed value of the permanent-type residential electric heating now in use exceeds \$1 billion, it is estimated, while the value of supplementary electric heating units (for bathrooms, attics, basements, extensions and similar locations) is even higher.

The value of shipments of electric heating equipment for 1959, 1960, and the first half of 1961 is given in the table "Electric Comfort Heating Equipment." These data, collected by BDSA, Dept. of Commerce, indicate that annual dollar volume is running at \$28 to \$33 billion, for equipment only, uninstalled.

Electric heating equipment also finds wide usage as an industrial commodity, for production processes requiring heat. While there are several types of industrial heating equipment using other means of heat than electricity, the electrically powered industrial heating

## ELECTRIC POWER GENERATING CAPABILITY IN U.S. (Millions of Kilowatts)



\* Installed capability as of December 31.

\*\*Forecasts by Electric Power Survey Committee of Edison Electric Institute, as of April 1962

Source: Federal Power Commission and Edison Electric Institute

systems are growing in popularity and use. Data on the total market are shown in the table "Industrial Heating Equipment Volume."

### Electrical Progress

The research and development work going on in the laboratories of the electrical industry is a potent factor in industry growth. It insures new and better products, geared to today's new needs. Fortunately, considerable research in other fields, such as space exploration, and military requirements, is being carried out in electrical laboratories, which will eventually also aid in furthering electrical progress.

Consider the telecommunication relay satellite "Telstar," for example, which was put into orbit in July of this year. This 170-lb satellite is crammed with electronic devices, and opens a whole new era of worldwide communications. While each electronic device performs a specific function, there will undoubtedly be many by-products from the research which led to the final development and launching of this highly successful experimental device.

Consider also the laser, or light amplifier (light amplification by simulated emission of radiation). This brand-new device is a sensation in the scientific and industrial world, which can only begin to

mark out the limits of its potential. It has sophisticated uses for the near future, and opens up new areas of pure science to explore. Essentially, the laser provides the same control of light waves that has been common practice with radio waves. In other words, the laser makes light waves "coherent," rather than a hodgepodge that it is normally. Already, hundreds of companies are investigating the laser, which embraces the electronics field, as well as optics and other fields. It is already one of the significant inventions of the century, and by-products of its research will undoubtedly be spectacular. Its own potential is only beginning to be imagined.

Another trend of importance to the electrical industry is the miniaturization of electronics components, and the expanding use of semi-conductor devices. A variable revolution is shaping up in this area.

Research is now being pressed into new means and methods of converting fuel into energy. This interest stems from the never-satisfied appetite of the electric utilities for new methods of producing energy. Currently under study and development are new types of generators, able to convert heat and chemical energy into electricity directly—and improve the efficiency of power production still further. In general, there are four prime



ELECTRIC COMFORT HEATING EQUIPMENT VOLUME

(Value\* of Shipments)

| Type of Equipment                 | Total Value* (1,000 Dollars) |        |        |
|-----------------------------------|------------------------------|--------|--------|
|                                   | 1959                         | 1960   | 1961** |
| Baseboard <sup>(a)</sup>          | 8,789                        | 8,861  | 4,320  |
| Convectors: <sup>(b)</sup>        |                              |        |        |
| Without fan                       | 5,068                        | 2,984  | 1,442  |
| With fan                          | 2,535                        | 3,365  | 1,561  |
| Radiant panels <sup>(c)</sup>     |                              | 645    | 256    |
| Radiant reflectors <sup>(d)</sup> |                              | 1,560  | 703    |
| Radiant glass panels              | 1,815                        | 1,711  | 786    |
| Unit heaters <sup>(e)</sup>       | 4,731                        | 5,706  | 2,870  |
| Warm air furnaces:                |                              |        |        |
| Central                           | 92                           | 370    | 347    |
| Floor                             | 52                           | 71     | 29     |
| Wall                              | 2,682                        | 2,474  | 1,013  |
| Duct                              |                              | 255    | 191    |
| Cable heating systems:            |                              |        |        |
| Cable only                        | 467                          | 674    | 339    |
| Room units                        | 1,327                        | 1,092  | 454    |
| TOTAL                             | 27,558                       | 29,768 | 14,311 |

\* At manufacturers' selling prices.

\*\* January-June 1961 only.

<sup>(a)</sup> Excluding glass panel type.

<sup>(b)</sup> Including ceiling or wall mounted, excluding glass panels.

<sup>(c)</sup> Except glass.

<sup>(d)</sup> Ceiling, pendant or wall mounted.

<sup>(e)</sup> Commercial and industrial, and unit ventilators—all types.

Source: Dept. of Commerce, BDSA.

areas of development under w  
*Thermoelectric* — electricity p  
duced directly from any type  
heat source through heat-simula  
action in small blocks of semi-c  
ductor alloys; *Thermionic*—e  
lectricity is generated directly fr  
heat by means of a gas-filled t  
in which electrons boil off from  
heated cathode; *Photovoltaic*  
thin layer of a photo-sensitive  
material in a solar cell converts li  
to electrical energy; and *Fuel C*  
—electrical energy is delivered  
rectly from continuous chemical  
action of air or oxygen with va  
ous fuels in packaged devices t  
resemble storage batteries.

The practicability of some  
these processes already has b  
proven. Solar cells, thermionic  
thermoelectric converters are be  
used and designed into space sa  
lites. One manufacturer has int  
duced two thermoelectric consum  
items: one, a 2-cu-ft capacity  
frigerator; the other, a room a  
conditioning system for cooling  
heating. It would appear that  
next major step in air condition  
progress might involve this th  
moelectric principle.

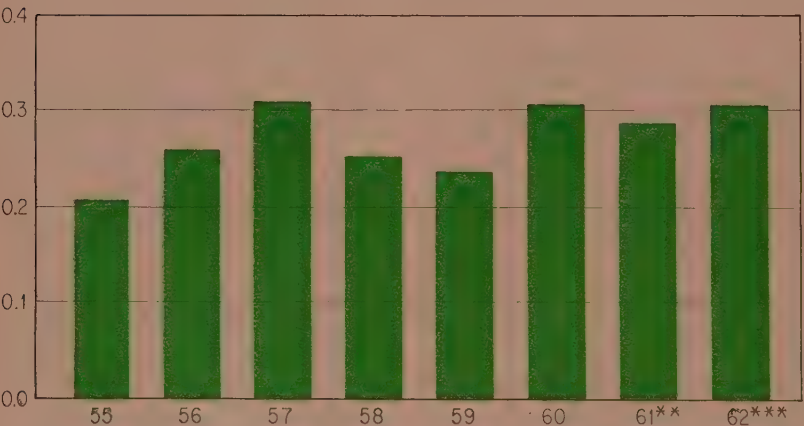
The Outlook

Currently, technological dev  
opments in the electrical indus  
are many, and will undoubtedly  
have a broad impact on the ind  
try in the years ahead. Electr  
industry markets and growth, ho  
ever, depend upon a healthy a  
growing economy for its o  
strength. In general, it would se  
that the short-range outlook for t  
economy is for a continuation o  
high plateau, with neither a bo  
nor a depression indicated. W  
new construction activity showi  
some strength, and with technolo  
cal developments helping to advan  
electrical standards, the outlook f  
the electrical markets, short-ran  
is for sound growth.

There are no valid signposts  
which to base a long range fo  
cast for electrical markets at th  
time. However, here too, the av  
age growth trends for various e  
nomic factors would seem to in  
cate that the economy will contin  
its general upward climb, even  
altered from time to time by cyc  
cal variations.

INDUSTRIAL HEATING EQUIPMENT VOLUME

(Value\* of Shipments)  
(Millions of Dollars)



Note: Industrial heating equipment includes furnaces and ovens, dielectric and combustion equip-  
ment, atmosphere gas generators, and other equipment.

\* At manufacturers' selling prices.

\*\* Estimated, as of December 31, 1961.

\*\*\* Forecast, as of January 1962.

Source: Dept. of Commerce, BDSA.





**TYPICAL** installation of starters and disconnect switches.



**A TYPICAL** installation of combination starters and disconnects.

# Selecting Motor Control Systems

Use of plain starters, combination starters and control centers is compared in an objective case study. The author discusses comparative costs and other practical considerations.

**By William H. Younger,** *Allen Bradley Co., Milwaukee, Wis.*

**A** GOOD many years ago, when belt drives were replaced by individual motors driving specific loads, plain starters were used and mounted at the location of the motor to be controlled. A disconnecting means was also mounted near the starter. Later, as safety and convenience of installation were stressed, combination starters were introduced to the market which combined both the disconnecting means (either circuit breaker or switch type) with the starter in a single enclosure. Still later, the desirability of grouping controls for a given production area led to the development and introduction of control centers which were really the compact floor mounted assembly of standard combination starters and other associated motor control devices.

The gradual evolution of these three separate and distinct types of motor control systems has led to a certain amount of confusion in the minds of consulting engineers, contractors, and users of motor control. Naturally, each type of system has certain advantages and disadvantages over the other. And although there has been a considerable amount of literature and publicity available on any one of these systems, there has been little, if any, information brought forth which compared one system against the other on a specific job.

Therefore, when we decided to make an objective study on this subject to compare the three motor control systems, it seemed best to start from "scratch," selecting an actual job and working out the total cost picture for material and labor.

Initially, we thought we might take an area of our own shop and work with this as a basic layout. However, tempting as this was because of its convenience, we discarded the idea because we felt to be truly objective in our study we should take an actual installation—a specific job that had been designed and purchased in the past.

Such an installation was found. It was an industrial building consisting of a basement, first floor, and second floor. Each floor had a variety of motor loads and represented different problems of layout and motor control application. The system was 3-phase, 440 volts.

With this basic information in hand, we approached an independent consulting engineer and asked for his assistance. We asked that he lay out each of the three floors



**TABLE A—Material Cost**

| FLOOR                 | CONTROL CENTER | GROUPED COMBINATION STARTERS | INDIVIDUAL COMBINATION STARTERS |                   |
|-----------------------|----------------|------------------------------|---------------------------------|-------------------|
|                       |                |                              | FED FROM PANELBOARD             | FED FROM BUS DUCT |
| BASEMENT              | \$2817         | \$1990                       | \$1946                          | \$2438            |
| MACHINERY             | \$4228         | \$3085                       | \$2975                          | \$3634            |
| LABORATORY AND OFFICE | \$2828         | \$1930                       | \$1995                          | \$2589            |
| <b>TOTALS</b>         | <b>\$9873</b>  | <b>\$7005</b>                | <b>\$6916</b>                   | <b>\$8661</b>     |

**TABLE B—Labor Cost**

| FLOOR                 | CONTROL CENTER | GROUPED COMBINATION STARTERS | INDIVIDUAL COMBINATION STARTERS |                   |
|-----------------------|----------------|------------------------------|---------------------------------|-------------------|
|                       |                |                              | FED FROM PANELBOARD             | FED FROM BUS DUCT |
| BASEMENT              | \$1542         | \$1673                       | \$873                           | \$1471            |
| MACHINERY             | \$2561         | \$2797                       | \$1321                          | \$1845            |
| LABORATORY AND OFFICE | \$1603         | \$1751                       | \$1061                          | \$1506            |
| <b>TOTALS</b>         | <b>\$5706</b>  | <b>\$6221</b>                | <b>\$3255</b>                   | <b>\$4822</b>     |

using the following motor control systems:

1. Using NEMA Class I Type A plug-in control centers having circuit-breaker combination starter plug-in units.

2. Grouping circuit-breaker combination starters at one location and controlling individual motors from that one area.

3. Mounting individual circuit-breaker combination starters at each motor location and feed these dispersed loads from a power panel.

4. Mount individual circuit-breaker combination starters at each motor and feed these individual loads from bus duct overhead.

The basement had ten different motor loads with horsepower ratings  $\frac{1}{2}$  hp up to 30 hp. Motors were for bilge pumps, hot water pumps, sewerage pumps, fans, compressors, refrigeration unit, and an overhead door. Loads were widely dispersed—often in different rooms.

The first floor was a machinery floor having 18 different motor loads. Fourteen of these motors were reversing applications on production machines rated  $7\frac{1}{2}$  hp. The remaining motors varied from  $\frac{1}{2}$  hp to  $1\frac{1}{2}$  hp and were for unit heaters and fans.

The second floor was a laboratory and office area having 11 motor loads—mostly in the 3 hp and 5 hp range for small machines. One 35-hp elevator motor was also to be controlled. Motors were again widely dispersed.

Estimating each of these three floors with the four different control system possibilities mentioned above gave us 12 areas of information for comparison purposes. The tables which follow give complete data regarding all material as well as labor required for the total installation of such material. Detailed estimating sheets were maintained and no item of expense was overlooked—regardless of how small it seemed. Nickels and dimes can add up rapidly. We wanted the study to be as complete and fair as possible.

In pricing material, a similar primary discount schedule was used on all items to place them on a comparable basis. It was decided that this would give a better picture than list prices which would be inflated. Thus, we are dealing with realistic purchase values as seen in today's market.

With regard to labor costs, standard units were applied and

extended to give us total amount, and these were translated into total dollar figures by applying a value of \$5.50 per hour. Although this figure is arbitrary, it seems to represent a sound average in the light of today's published figures across the country.

When we first began this study we talked with a number of people who had very strong personal opinions as to which control system would be most expensive. For example, one capable engineer said flatly that control centers cost three times as much as plain starters. When we asked him to describe what he meant by "three times as much" as it related to material, or labor, or both, he really did not know. In other words, he was expressing a general "rule of thumb" which apparently he had applied over the years without much basis in fact. It may have been that on one particular job his very general statement was true, but many factors may have contributed to this example which he was continuing to hold forth as a basic truth.

In our study, we emphasize the fact that we are trying to draw only broad conclusions by analyzing in detail a very specific job. The figures developed in Tables A through D tell the story.

In Table A we have compiled the material cost—involving all of motor starting equipment, wire, conduit, connectors, boxes, straps, and even bolts. On each of these floors and in the total job, the control center system was the most expensive. This is logical since the control center itself comprised 70 to 75% of the total material cost on any given floor. The bus duct system feeding individual combination starters was second highest in cost. It is interesting to note that the bus duct itself was a significant factor—between 30 and 40% of the material cost on each of the floors. The grouped combination starters ranked third in material cost and the individually mounted combination starters fed from a panelboard ranked fourth.

The comparison of labor cost shown in Table B presents quite a different picture from the material cost analyzed previously. Note that the two installations involving the grouping of controls—grouped combination starters and control centers are both more expensive than the feeding of individual combina-



tion starters from panelboard or bus duct. This is quite logical since in the grouping of motor controls at one location, almost twice as much wiring is involved as the control and power wires are taken from the centralized control point out to each motor. In addition, the wiring is heavier—thus adding to the labor cost. From the point of labor installation cost, the grouped combination starters are most expensive with the control center ranking second. Again an effort was made to include all elements of labor cost. For example, in the control center allowance was made for cartage, setting, and leveling the control center. The bus duct and individual combination starter system ranked third. The labor cost of installing the bus duct is relatively high but additional motors can be added at fairly low cost. Saying it another way, the cost per motor additional decreases rapidly once the bus duct system is installed because there is available power close to the motor to be controlled. This is in contrast to the control center and grouped combination starters where a relatively constant additional cost per motor is involved when additions to the load are made.

Table C gives us a consolidation of both the material and labor cost for the four different control systems applied to each of the three floors. It can be quickly observed here that although the control center system is the highest of the four and the individual combination starters fed from a panelboard is the lowest, the grouped combination starters and bus duct feeding individual starters are about a "stand off" in combined costs due to the higher labor cost for one and higher material cost for the other. It takes more labor to install the grouped combination starters but the material cost for the bus duct system is higher—thus effecting the balancing out. Naturally, these figures could change for any given floor installation due to the number and grouping of the motors on that particular floor.

At this point in our study we turned our attention to plain magnetic starters with separately mounted disconnects adjacent to each starter. Although we had thoroughly compared centralized versus dispersed control in terms of control centers and combination starters, it remained to observe the role of the plain magnetic starter

and its comparison with the other systems.

Up to this point, we have been dealing with circuit-breaker units both in the control center and in individual combination starters. However, because most plain starter installations with separate disconnects utilize a safety switch, this seemed to be the most realistic approach to the problem. Nevertheless, to avoid comparing "apples and bananas" we decided to compare the circuit-breaker combination starters previously discussed with plain starters and safety switch disconnects and also insert fusible combination starters to complete the picture. This information is given in Table D where complete material and labor costs are tabulated.

Starting with the grouped circuit-breaker combination starters tabulated previously, similar data were developed for the fusible combination starters. A reduction of approximately 10% in total cost was noted. Then, pursuing the same reasoning with plain starters and safety switches, another total cost is developed which again represented a decrease of approximately 10% below the fusible combination starter cost. Certainly, this lower cost is arrived at through the sacrifice of a number of installation features including safety, compactness, and appearance.

At the same time that we were making this detailed analysis of one specific installation in an effort to come up with some cost figures, we made a special effort to visit as

**TABLE C—Material and Labor Cost**

| FLOOR                 | CONTROL CENTER | GROUPED COMBINATION STARTERS | INDIVIDUAL COMBINATION STARTERS |                   |
|-----------------------|----------------|------------------------------|---------------------------------|-------------------|
|                       |                |                              | FED FROM PANELBOARD             | FED FROM BUS DUCT |
| BASEMENT              | \$4359         | \$3663                       | \$2819                          | \$3909            |
| MACHINERY             | \$6789         | \$5882                       | \$4296                          | \$5479            |
| LABORATORY AND OFFICE | \$4431         | \$3681                       | \$3056                          | \$4095            |
| <b>TOTALS</b>         | <b>\$15579</b> | <b>\$13226</b>               | <b>\$10171</b>                  | <b>\$13483</b>    |

**TABLE D—Material and Labor Cost**

| FLOOR                 | COST         | CIRCUIT-BREAKER COMBINATION STARTERS | FUSIBLE COMBINATION STARTERS | PLAIN STARTERS AND DISCONNECTS |
|-----------------------|--------------|--------------------------------------|------------------------------|--------------------------------|
|                       |              |                                      |                              |                                |
| BASEMENT              | LABOR        | \$1673                               | \$1673                       | \$1735                         |
|                       | MATERIAL     | 1990                                 | 1819                         | 1562                           |
|                       | <b>TOTAL</b> | <b>\$3663</b>                        | <b>\$3492</b>                | <b>\$3297</b>                  |
| MACHINERY             | LABOR        | \$2797                               | \$2797                       | \$2944                         |
|                       | MATERIAL     | 3085                                 | 2722                         | 2227                           |
|                       | <b>TOTAL</b> | <b>\$5882</b>                        | <b>\$5519</b>                | <b>\$5171</b>                  |
| LABORATORY AND OFFICE | LABOR        | \$1751                               | \$1751                       | \$1801                         |
|                       | MATERIAL     | 1930                                 | 1706                         | 1415                           |
|                       | <b>TOTAL</b> | <b>\$3681</b>                        | <b>\$3457</b>                | <b>\$3216</b>                  |
| <b>TOTALS</b>         | LABOR        | <b>\$6221</b>                        | <b>\$6221</b>                | <b>\$6480</b>                  |
|                       | MATERIAL     | <b>7005</b>                          | <b>6247</b>                  | <b>5204</b>                    |
|                       | <b>TOTAL</b> | <b>\$13226</b>                       | <b>\$12468</b>               | <b>\$11684</b>                 |





**A TYPICAL** motor control center.

many installations across the country as possible. Many of these users had purchased control centers; others had gone to one of the other systems described. In each case our questions were directed toward finding out why the selection had been made and what factors had influenced the purchase.

It soon became very obvious that the analysis of installation cost was only one consideration involved in the purchase of a system—and sometimes a minor one at that.

Because ten such influencing factors were noted most often, they are worthy of review. Here they are:

**1. Environment of the installation** has a big bearing on the selection of the system. As one food processing plant engineer said to me, "They are constantly hosing everything down in this plant and I can't afford to have them get any water into my motor control equipment so I move it into another room." This problem is not only limited to food processing plants, dairies, or breweries but is also a common problem in paper mills and steel mills. Dust or dirt in the air, corrosive fumes, or water and other liquids can play havoc with the electrical equipment, and oftentimes the best answer is to move the control outside the production area into a dry, clean environment. This thinking automatically rules in favor of consideration of grouped controls such as a control center or grouped combination starters.

We observed one paper mill that had a highly corrosive atmosphere. They had placed control centers in a separate room which was pressurized with special filters to avoid the problem of static corrosive air and to keep dirt and dust out. This problem, incidentally, of filtering the air is not an easy one to solve.

**2. Electrically interlocked process machinery** requires a great deal of interwiring between the various motor controllers. In many of these installations the operator may press a single button and the complete line, consisting of many motors, begins to operate at once. Naturally, the electrical interlocking of many motors with the attendant complicated interwiring means that a man in one of these plants would be very favorable to grouped control where this wiring could be performed more easily—not only initially but later during maintenance. A great many chemical plants face this type of problem, and it certainly influences their selection of motor control.

**3. Close supervision of production** is required in costly and complicated manufacturing processes. An electronic device manufacturer told me, "It would be ridiculous for me and my men to have to run around to all of the many machines and pieces of equipment in my plant to observe that everything is going along right. We want all our control in one place so that the one man who is responsible can keep an eye on the complete operation with-

out running himself silly." Here, again the grouping of control with appropriate pilot lights and accessory devices will give maximum supervision with greatest efficiency.

**4. Installation of equipment** brings on many problems which naturally vary from one user to another, but his view of these problems may influence his selection. By way of example, one chief engineer told me that he had a stable and fairly small electrical group operating in his plant, and he preferred to keep it of a given size. Although he didn't want to expand his crew, he realized that he had some electrical expansion work to do and, therefore, he was interested in "buying labor" wherever possible. This man preferred control centers because, as he put it, "The manufacturer does a lot of my work ahead of time in a control center. He does all the interwiring and makes the job easier for me to finish off." This installation consideration was a definite influence on this customer's buying decision.

**5. Maintenance expense** is certainly a part of the over-all picture considered by most users. Although all users are concerned about maintaining their equipment, the difference in downtime cost makes some far more aware of this than others. The man who has no particular difficulty in shutting down one or two of his production machines and working on them while the others continue to operate looks at the selection of a system and its maintenance one way. But the man who must shut down his complete production facility if just one machine needs repairs looks at the selection of his system in quite a different manner. In one mill, where downtime is very expensive, grouped control was preferred because there was just one spot to go to. The control centers purchased had even been outfitted with special "quick opening" door fasteners so that maintenance crews could get at any and all units with no delay in case of an emergency. The plug-in feature of control centers also appealed to this mill because individual units could be replaced most rapidly.

**6. Appearance** is often considered an intangible factor in the selection of an electrical control system, but our study reveals that it is becoming more and more important to buyers. We observed one large industrial plant that decided



to use a control center in a separate room and when it was realized that visitors to the plant could not see the installation, large glass windows were placed on the wall so that the electrical equipment could be shown off to visitors to better advantage. We have seen the same thing in many public buildings, where fine appearance was a significant influence on the purchaser. After all, a modern electrical control system represents a sizable investment and the buyer is not at all bashful about wanting to show this off to the public. In some cases he is actually making a "show piece" out of the motor control.

**7. Space** is a subject about which much has been written in recent years. We see more and more emphasis on "space shrinking" of all equipment going into a modern industrial facility. Companies are seeking more and more ways to get maximum output from available floor space. A comment made by one industrial user was probably not unusual: "Our management tells me that every square foot of this plant is worth \$2.75 a year in profit to the company. Therefore, every square foot of space that I want to use for my electrical equipment had better be justified."

Actually, the word "space" can be very misleading since it means different things to different people. One man may say that he uses combination starters grouped on a wall because it takes no floor space. The next man will tell you that he doesn't have the wall space available and, therefore, he uses control centers because they take up a minimum of floor space. Still another will tell you that he likes to mount the motor control right on the machine or near the motor because that really saves space. It all depends on the installation.

We would add one word of caution here. Some companies have become so intent on saving floor space that they have moved their motor control into inaccessible areas. Here we are not talking about a separate room but instead mounting equipment up in the rafters or down in the depths of the building in a locked room where it is not accessible in times of emergency. This is, of course, shortsighted.

The competition for available space within a plant between departments is sometimes most interesting to watch. One plant man

told me that he liked control centers because he could locate his control center very early on the production floor. He found out where major loads were going to be located—in a general way. Then he moved the control center into the plant and grouted it to the floor. "They know my mind is made up," he said, "and besides, they don't take my space away from me."

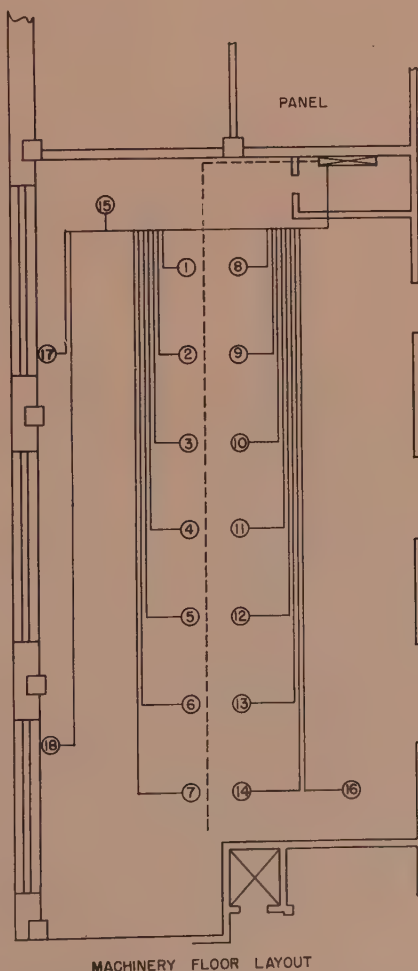
**8. Future expansion** certainly must be considered—particularly the way the electrical requirements in many plants have skyrocketed in recent years. Companies are constantly rearranging and improving their production facilities to improve their efficiency. It is easy to run out of space—any kind of space—in a hurry. In addition, of course, the electrical equipment must be kept conveniently located for proper maintenance.

One company we visited was particularly interested in control centers because they felt it was easiest to expand with this type of system. In many cases, in new construction, motor loads were not definitely

known and yet the electrical system had to be "tied down." This is not necessarily anyone's fault. It merely indicated that changes are taking place constantly. In the case of one industrial plant, large blank control center sections were ordered. These were located and at a later date control center plug-in units were purchased (sometimes under the maintenance budget) to match the motor requirements. This gave flexibility but did not hold up the construction job.

**9. Safety** is becoming increasingly important. As the tempo of work picks up and electrical loads get larger and larger, safety to all operating individuals involved is being stressed in plant after plant. Good code practice is followed and no stone is left unturned in the search for maximum safety. Generally speaking, the control center or combination starter represents a safer installation than the individual safety switch and plain starter. As mentioned previously, the growing awareness of safety helped spur the development of the combination starter a number of years ago. In any given plant, safety as an influence on the thinking of that plant depends on several factors. Accidents that may have taken place over the years, the type of processes in use, and the attitude of the management and supervisory people are all important.

**10. Personal prejudice** on the part of the buyer time and again was one of the most important single factors involved. We often encountered individuals who were buying a certain type of system because it was "best." As we chatted with them and began to investigate their thinking, it turned out that they were not too sure why they felt the way they did. However, they certainly had very strong feelings on the matter. For example, we encountered two very similar industrial plants, operating in the same industry and making the same product, that were located just a few miles apart. In each plant there were competent and experienced electrical engineering and maintenance personnel. However, in the first plant the customer was one hundred per cent sold on the use of control centers as being "ideal" for his installation. Nothing could be better than control cen-



**MOTOR LAYOUT** on one of the three floors used in the control case study.

(Continued on page 195)



# Independence Hall

## Echoes the Past

*... through sound and light*

Our Country's beginning is dramatically portrayed by magnetic-tape sound-track equipment, coordinated with fixed and varying 5-color illumination. Performances are presented each evening on the historical grounds of Independence Hall. E-J Electric Installation Co., New York City, was constructing engineers for the entire project.



**INDEPENDENCE HALL**, as viewed from the ground, shows no evidence of fixed floodlighting units installed at many points on the exterior of the building. Accompanying photos reveal well-hidden locations of luminaires.

**T**HROUGHOUT the years, countless daytime tourists have visited Independence Hall, one of America's most sacred historical sites. For it is this Philadelphia landmark that houses the Liberty Bell and is proudly revered as the building in which the "Declaration of Independence" was signed in 1776.

Since this last Fourth of July, however, tourists have been in for a real treat—a nighttime, outdoor historical performance viewed from the park area behind Independence Hall. This evening performance, called "The American Bell" dramatizes the events leading up to the signing of the Declaration of Independence. And the program consists of fixed and varying 5-color illumination, coordinating and functioning with magnetic-tape sound-track equipment.

Lighting and sound systems are controlled from electronic dimming and amplifying equipment, located in an underground control room. This equipment is the nerve center of the coordinated systems and, basically, operates on a 10-channel, high-fidelity magnetic-tape system which controls music, sound effects, narration, dialogue, and the elaborate lighting system in a planned programmed sequence. Most of the lighting combinations are controlled in color, intensity and position by a complex Thyatron dimming system, similar to that used in major theatrical and studio productions.

Because of the intense heat generated by amplifiers and dimmers,

a 5-ton air conditioning unit was required in the control room to maintain normal room temperature.

From the control center, conduits extend to exterior and interior lighting units on Independence Hall and adjoining buildings. And underground cables supply fixed and portable lighting banks in the park area. Around the park area surrounding the audience, column-type portable speakers provide life-like stereophonic sound throughout the performance.

### **Installation Features**

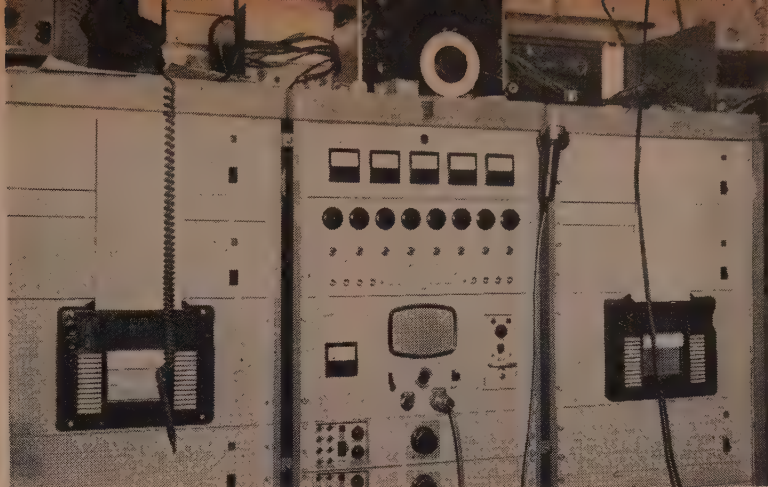
The E-J Electric Installation Co., New York City, served as the constructing electrical engineers for this \$250,000 project. Their background of experience in the performing arts field assisted in the coordination necessary between all departments of the federal government and the City of Philadelphia. The entire installation, including trenching and backfilling, resodding, masonry and carpentry work, and construction of park benches (ingeniously used in connection with the lighting system) was performed by E-J Electric.

Some of the important electrical specifications included: use of aluminum conduit boxes and fittings throughout the interior and exterior of Independence Hall to avoid corrosion of metallic parts; use of Type USE single- and multiple-conductor cable for all underground work; matching receptacles for plug-in lighting and speakers at



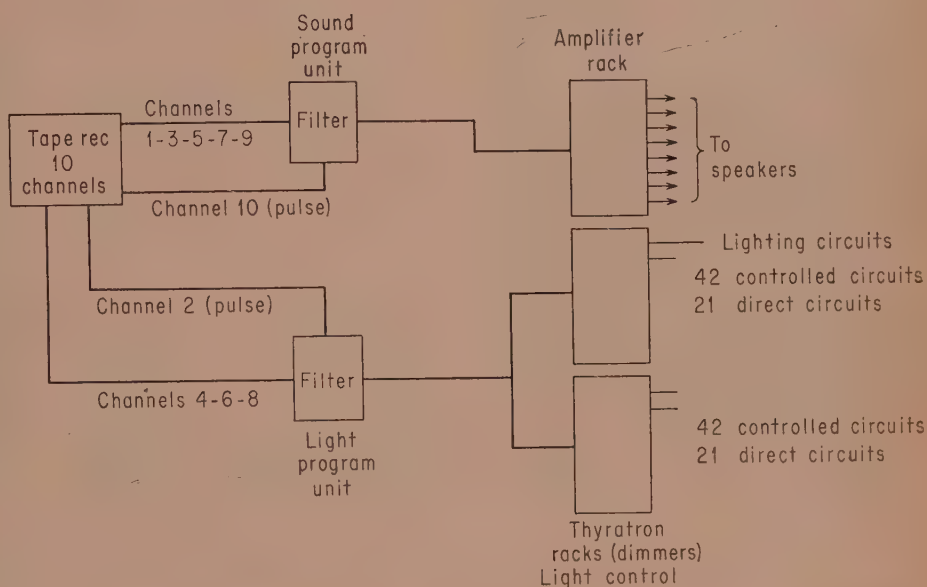


**COLUMN-TYPE SPEAKERS** are typical of eight such portable outdoor units which surround the evening audience in the park area of Independence Hall. During the day portable speakers are removed.



**SOUND AND LIGHT** are coordinated by control equipment located in an underground room. This equipment keys the lighting system to the sound production of "The American Bell," through variations of lighting intensity and color.

**BASIC BLOCK DIAGRAM** of sound and lighting equipment shows how the evening performance of "The American Bell" is presented at Independence Hall. The equipment operates on a 10-channel, high-fidelity magnetic-tape system which programs, music, sound effects, narration, dialogue, and the elaborate dimmer-controlled 5-color lighting system.



receptacle strips located inside the park benches; and automatic alignment of outdoor portable lighting standards and column-type speakers.

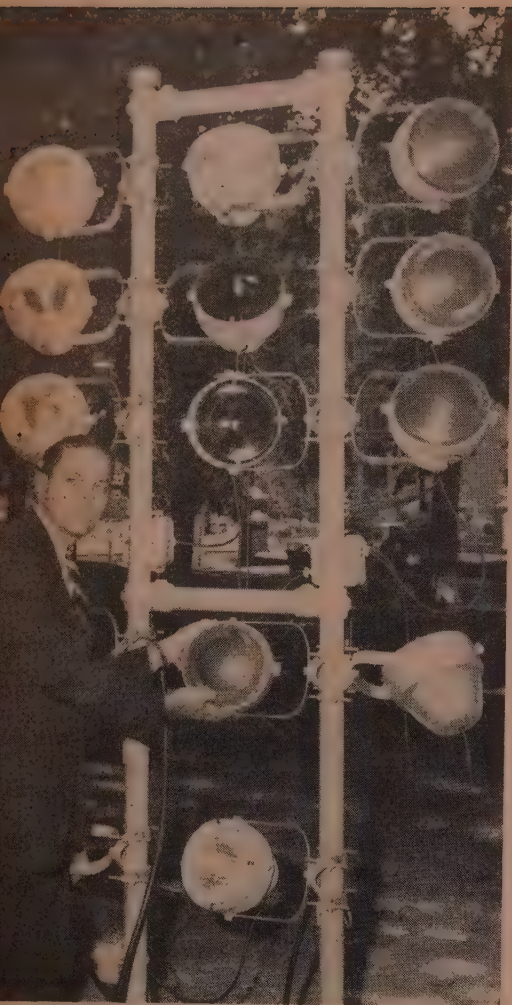
One of the major problems encountered was the emphatic request on the part of the National Park Service and Department of Interior that the sacred and historical grounds of Independence Hall could not be marred or littered with objectionable lighting units or related equipment which would distract from the original Colonial appearance.

To accomplish this, many of the park lighting units are mounted in redwood park benches. These custom-designed benches have hinged fronts and seats. During the day the fronts and seats are closed and locked by key so that the public can use the benches to rest and view

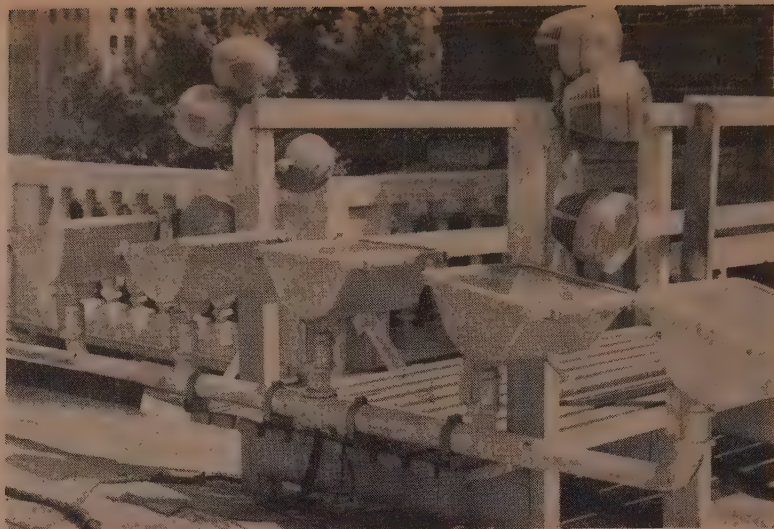


**PORTABLE LIGHTING STRIPS** are located in small metal boxes and placed near the building face. Each strip box contains a white, red, and yellow PAR lamp to accent red brick in nighttime sound-light spectacular.





**J. ROBERT MANN Jr.**, vice president of E-J Electric Installation Co., makes final adjustments on typical portable lighting standards installed in the park area of Independence Hall. The multi-colored lighting banks are used during evening sound-light performance to illuminate buildings.



**AURORA LIGHTING EFFECT** is accomplished by five 1500-watt quartz lamps (foreground) that shine up in the sky and silhouette the tower of Independence Hall. Weatherproof PAR lighting units (above quartz lamps) illuminate building surfaces. The units are located on the roof of the main part of the building and cannot be seen from ground level.

**TYPICAL PERIMETER LIGHTING** for illuminating building surfaces consists of weatherproof luminaires with PAR lamps. Units are carefully placed behind ornamental pieces so they cannot be noticed from ground level. Boxes and liquid-tight conduit are secured to old structure members by wrap-around straps. This prevents damage to ancient wood members.



the surroundings. For the night performance of "The American Bell," the fronts and seats are opened so that the batteries of floodlights can illuminate all of the buildings as required during the sound-light presentation. Additional floodlights, mounted on portable self-aligning stanchions and in portable strip boxes, are strategically placed around the park area. During the day all portable units are removed and stored away.

Independence Hall itself has an extensive wiring system which supplies lighting to all rooms in addition to illuminating parapets and other exterior building surfaces. Adjacent east and west wing buildings are illuminated in a similar manner, but they are also floodlighted from lighting units on the

roof of Independence Hall. As indicated in accompanying photos, all fixed lighting units on the building structures are so installed that they cannot be seen from ground level during the day. Portable lighting stanchions in front of the building and in a number of inside rooms are stored away in the daytime hours.

On an upper exterior section of Independence Hall, five 1500-watt quartz-lamp floodlights provide a spectacular "aurora" effect by shining up in the sky and silhouetting the tower of Independence Hall. Although used for only a short time during the performance, this lighting provides a dramatic punch at a key part of the taped program.

To produce a darkened area for outdoor audience seating at night, many of the old gas lights in the

park area have been converted to electric lamps. But to maintain the tradition of the gas lights, small 40-watt flame-shaped bulbs were selected. These lamps are also controlled from the dimming equipment in the control center.

Circuit and control wiring for sound and light program units are extended to a junction box near the control equipment where the conductors are connected to separate terminal blocks. As a result, jumpers can be easily installed should a change in script or a new script be desired in the future. Spare magnetic tape is available at the control center in case the original tape should break.

Twelve miles of wire and cable, 300 floodlights (ranging in size from 100 to 1500 watts), and eight





**MAIN JUNCTION BOX** for underground runs to park area from panel-board, dimmer and sound circuits is located adjacent to control equipment. Terminal blocks in the cabinet shown at the left of photo simplify connection changes for sound and lighting circuits when revisions are made to magnetic-tape recordings.



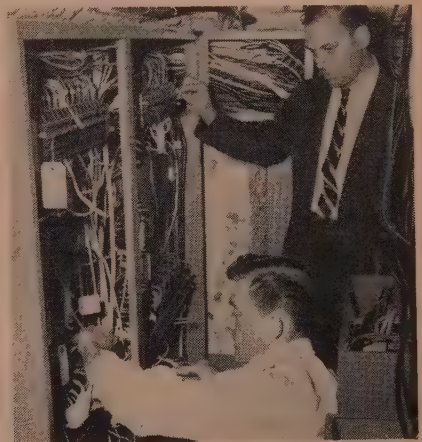
**CONDUIT, BOXES AND FITTINGS** used throughout Independence Hall are aluminum. This was specified because the building is not heated. Photo shows wiring in attic spaces of building.



**TYPICAL CONVERSION** of gas lights to electric lamps is shown as electrician completes wiring. Wires were fished up old standard and a short offset piece of copper tubing with compression connectors feed side-connected socket. The flame-type bulbs are dimmer regulated.



**RECEPTACLE OUTLETS** in historical rooms of Independence Hall are installed behind original baseboards. When not in use, a beveled flush wooden cover closes opening, thus maintaining the original Colonial appearance.

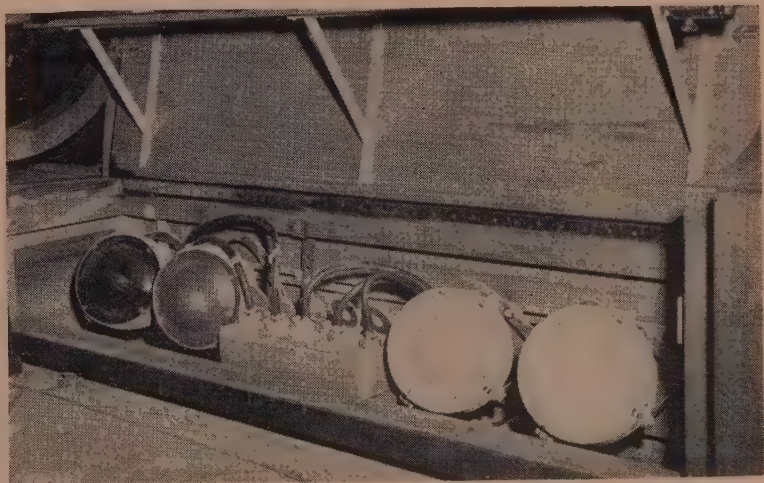


**FINAL TESTS** are made by E-J Electric personnel at custom CB panelboard, located behind Thyatron dimmer panel in underground control room. Wire sizes for lighting circuits range up to No. 4 because of long runs to the park area and upper parts of building.

outdoor, column-type speakers were required for "The American Bell" performance. The lighting load is about 80 kva, and the entire load for the production, including the load for dimmers, amplifiers and related equipment totals 100 kva.

The script for "The American Bell" was written by Archibald MacLeish and is narrated by actor Frederic March. Voices representing Thomas Jefferson, Benjamin Franklin, George Washington, John Adams and others were recorded by well-known actors and actresses. J. Robert Mann Jr., vice president of E-J Electric, supervised the entire construction project.

Expectations are that similar sound-light productions will be provided at other monumental sites throughout the United States.



**CUSTOM REDWOOD BENCHES** in the park area serve dual function. During the day, the public uses them as park benches. At night, hinged front and seat covers are opened to permit floodlights to illuminate buildings during sound-light performance. Receptacles are coded to match the appropriate colored lens.



*Safety is the objective in . . .*

# Grounding of Plug Connections

Here's a basic rundown on the techniques of grounding plug-connected devices through effective use of grounding receptacles and plug caps on various types of wiring systems.

By William Sunter, Manager, Commercial Engineering, Harvey Hubbell, Inc., Bridgeport, Conn.

**E**FFECTIVE application of grounding-type receptacles and plug caps can add real safety in the use of plug-connected tools, appliances and devices. Proper plug connection can provide firm grounding of noncurrent carrying metallic parts of equipment to eliminate electrical shock hazards which arise when insulation in equipment fails.

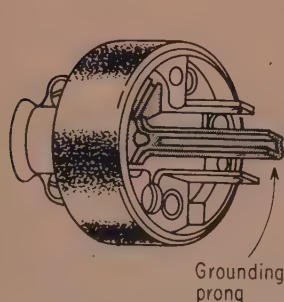
An electrical system or appliance is said to be grounded when those metallic parts of it which are not intended to carry current are connected, through a conductive material, to a water pipe or metallic electrode buried in the earth. The purpose of such a connection is to carry electricity harmlessly away if it leaks into uninsulated metal because of misuse or failure of insulating materials or energized conductors.

In the absence of such protective grounding, a

person touching the accidentally charged metal might suffer shock, severe burning, or death as a result of electricity flowing to earth through the body.

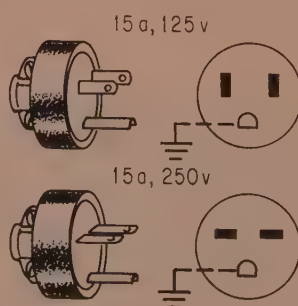
Fault currents can occur in any electrical system. But they are more common in a system in which flexible rather than fixed conductors are used, such as cord-and-plug connected devices. It is generally recognized that grounding portable equipment reduces electrical accidents. Only by properly insulating exposed metal parts and housings is optimum protection achieved. Unfortunately, this is not always feasible because certain types of equipment would be too bulky to handle conveniently if they were protected with the ideal amount of insulation. Hence the need for wiring devices with built-in protective features.

The accompanying illustrations cover specific details on grounding through plug connections.

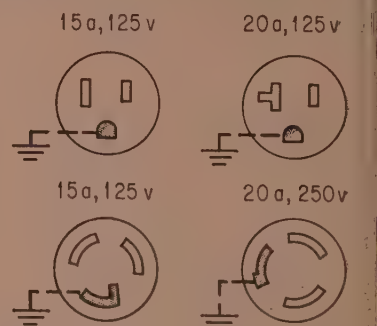


**A.** For the grounding of equipment operating from a flexible cord, a male attachment-plug cap is used which has one more contact blade than is required for carrying line current.

This grounding blade is longer than the others. Hence, when the cap is being plugged into a receptacle, the ground connection is established before the current-carrying blades make contact. When the cap is being removed, the current-carrying blades are disconnected first, before the grounding connection is interrupted, thereby assuring continuous grounding protection.

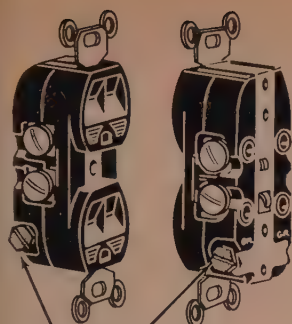


**B.** Since 1953, the current-carrying blades of grounding caps on flexible cords from equipment built for 125-volt service have been so designed that they cannot be plugged into the slots of 250-volt receptacles. Blades and slots for 125-volt circuits are parallel, whereas blades and slots for 250-volt circuits are in tandem. Special blade and slot configurations are made for 125-, 250- and 277-volt applications. Hence, equipment cannot be plugged into the wrong voltage.



**C.** Special slot configurations for different amperages prevent the plugging in of equipment that would overload a circuit. Cord caps for equipment drawing 20 amps will not fit into the slots of grounding connectors rated for 15-amp service. Thirty-amp caps will not fit into the slots of 20-amp or 15-amp receptacles, and so on.



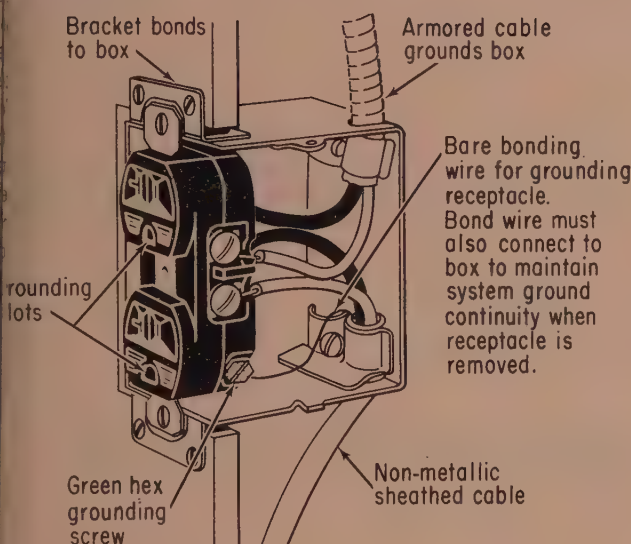
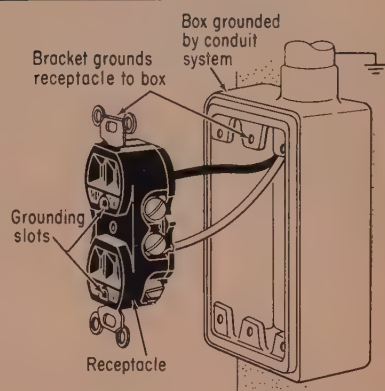


Ground terminal is green hex head screw on both sides

**D.** A receptacle with a grounding slot has a clearly identified grounding terminal, which may be connected back to the system grounding electrode in one of several ways:

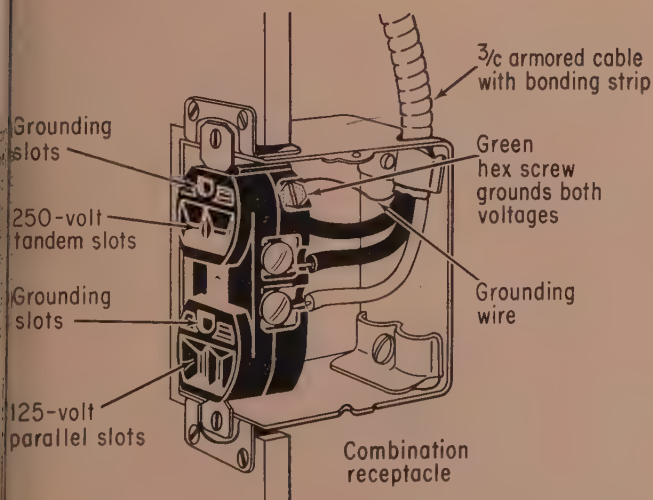
1. By a separate wire from the terminal to the water pipe or other electrode.
2. By an extra wire in the cable, conduit or raceway that houses the current-carrying wires. To this extra wire are connected the grounding terminals and housings of all wiring devices back to the service-entrance ground connection.
3. By the metal shell of the wiring system itself. Flexible conduit, EMT, rigid metal conduit or the armor on armored cable, properly installed, forms a conductive contact with all metal wallboxes, junction boxes, switchboxes, and fuse or circuit-breaker panels back to the permanent service entrance ground connection. Also, the grounding terminal of the receptacle is internally connected to the metal parts (the mounting bracket) by which the device is fastened to its housing. If this housing is a metallic box already properly grounded, the receptacle itself will automatically be grounded through it.

With a properly grounded metallic system (conduit or armored cable) receptacles are grounded through the mounting bracket which is metallically connected to a metal box which, in turn, is grounded through the metal raceway or cable armor applying it. If it is felt necessary, an additional wire may be installed in the supply conduit to provide a separate grounding connection to the green hex head screw. Or, the connection of mounting bracket to box is judged to be an unreliable ground connection, a separate jumper can be used from the green hex head screw on the receptacle to a solid screw connection on the inside of the box. The grounding wire is mandatory in non-metallic wiring systems.



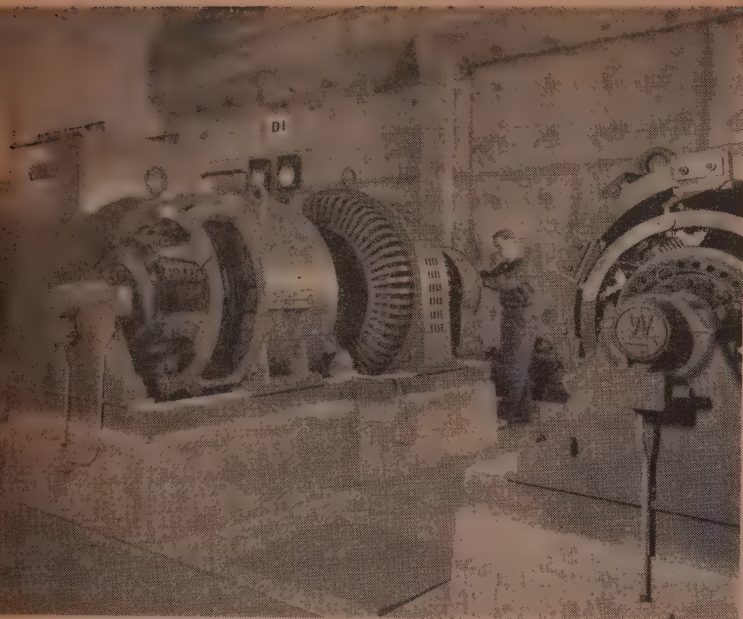
**F.** When a grounding receptacle is used with flexible metallic or non-metallic cable, the bare bonding or grounding wire from each cable entering the box can ground the receptacle by connection to the green hex screw. If a non-metallic box is used with non-metallic sheathed cable, the bare grounding conductor only has to connect to the receptacle grounding screw. If a metal box is used with non-metallic sheathed cable, the bare grounding wire in the cable can be solidly screwed to the box wall to ground the box and the receptacle ground connection is provided by the mounting bracket connection to the box. All cable bonding wires in any box should be spliced together to assure ground continuity of the wiring system when the receptacle is removed.

When armored cable is used, ground connections for the green hex head screw on the receptacle can be provided in either of two ways. First, the bonding strip in the cable can be wrapped back under the cable box connector with the receptacle ground connection again being provided simply by the mounting bracket in contact with the box, which is grounded by the cable armor. Or the bonding strip in the armored cable can be connected to the green hex head screw. In the latter case, there will be two ground paths from the receptacle to the armored cable: one through the bonding strip and the other through the mounting bracket to the grounded box and cable armor. In this diagram, the bonding wire from the non-metallic cable must be bonded to the box for system continuity.

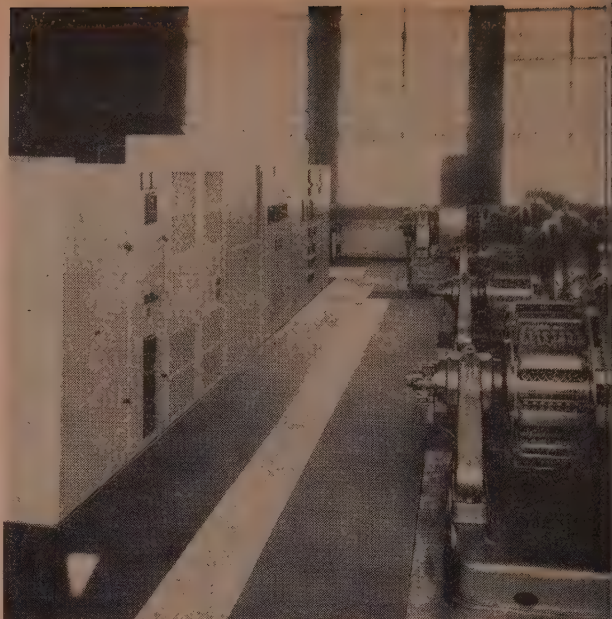


**G.** Combination duplex receptacles have common grounding terminals. Grounding to the system is accomplished in the same manner as described previously.





**MOTOR-GENERATOR SETS** provide reliable service and have a proven long life. They are capable of delivering large amounts of dc power. Large motor-generator sets require massive foundations (as shown above) to prevent excessive vibration.



**ROTARY CONVERTERS** have a high efficiency and, like motor-generator sets, are capable of delivering large amounts of power. Because the rotary converter combines ac motor windings and dc generator windings on one armature, it is smaller for the same kw output, thus requiring less floor space.

*For industrial service . . .*

# Rotating Equipment For AC to DC Power Conversion

Motor-generator sets and rotary converters—Part 1 of a 3-part series of articles which describes characteristics, operation, ratings and maintenance considerations of industrial power-conversion apparatus. Parts 2 and 3 will discuss rectifier circuits, ignitrons and silicon rectifiers in detail.

By **Charles G. Cloern**, Power Conversion Engineer, Westinghouse Electric Corp., East Pittsburgh, Pa.



EFFECTIVE selection, efficient operation and simplified maintenance of industrial power-conversion equipment require, fundamentally, a practical knowledge of available apparatus. Providing pertinent information, this series of articles will assist designers, electrical contractors and plant electricians in their responsibilities related to equipment that converts ac power to dc.

Originally, many plants generated ac, but if not all of their own electric power. This generated power was in the form of ac, but as loads increased it became more economical to purchase the power in the form of ac and convert it locally to dc. Motor-generator sets and rotary (synchronous) converters initially accomplished this conversion. Somewhat later, apparatus such as ignitron, selenium, and silicon rectifiers came available to provide dc power.

And the industrial uses of dc power are numerous and diverse. A conservative estimate is that 9% of all ac power generated in this country is converted to dc power for industrial uses.

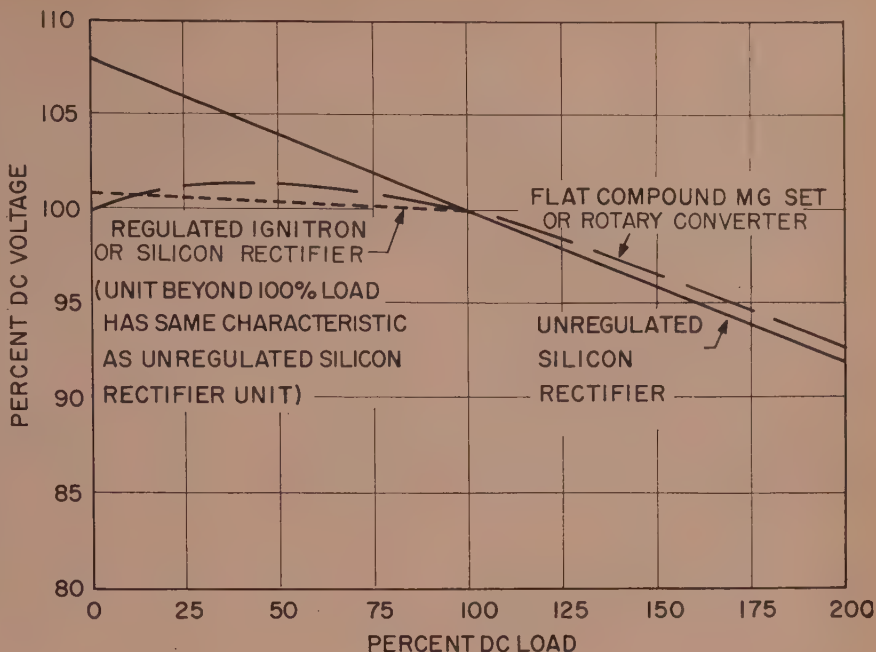
In general, there are two basic types of industrial dc systems, the constant-voltage, 250-volt, 2-wire distribution system, and the variable-voltage system, which is used extensively in motor control circuits. Conversion equipment discussed here covers apparatus related to the more common constant-voltage, 250-volt system. In this system, these equipments supply dc power to a common bus for such applications as hoisting cranes, magnetic separators, magnetic pulleys, and general industrial machine-tool drives.

### Motor-Generator Set

The motor-generator set is the oldest, and perhaps the most easily recognized apparatus for electric power conversion. For years it was the only practical means of obtaining large amounts of dc power. In its most common form, the motor-generator set is a combination of an ac motor and dc generator utilizing a common shaft, base, and bearings. Such assemblies, known as 2-unit, 3-bearing sets are available in ratings up to several thousand kilowatts. An outline and dimensions for several typical ratings are as shown in Fig. 3.

The driving motor is either of

FIG. 1-VOLTAGE REGULATION CURVES FOR DC CONVERSION EQUIPMENT FOR 250-VOLT DC INDUSTRIAL SERVICE



the induction or synchronous motor type. Motors of either design can be built for ac voltages from 440 to 13,200 volts, thus eliminating the need for step-down transformers on most industrial systems. The induction motor is the simplest, most maintenance-free machine, and has the lowest first cost, but it has the disadvantage of low power-factor operation. On the other hand, the synchronous motor has the advantages of being able to correct for low system power factor and of operation at constant speed with varying generator loads. But it requires more complex switching and control equipment, and requires more maintenance than the induction motor.

The dc generator is normally furnished compound wound with provisions for external series field strength adjustment. Proper adjustment of the series field strength will provide either drooping or flat voltage characteristics as shown by Fig. 1. A manually operated shunt field rheostat permits adjustment of the generator voltage to suit various operation conditions.

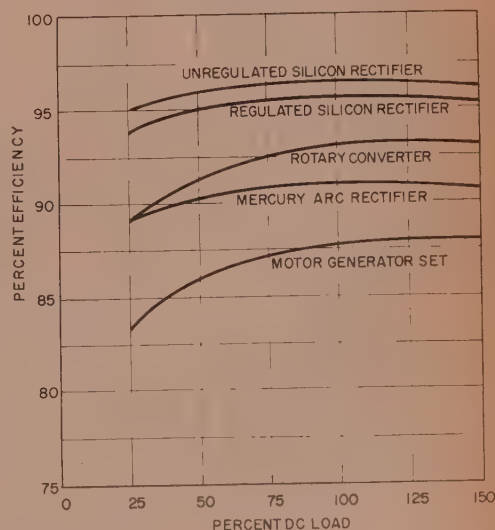
Generator output voltage is essentially constant. With a given field strength, the voltage of a dc generator is a direct function of the armature speed. And, because the ac driving motor speed is practically constant for any given load and relatively independent of small ac voltage changes, small variations in

ac system voltage are not reflected in the generator output voltage.

Air cooled, the motor-generator is suitable for operation in a maximum ambient temperature of 40° C. Most sets in use today are built with either Class A or B insulation for operation at either 40° C or 60° C temperature rise.

The nameplate duty cycle of motor-generator sets for industrial duty is established by ASA Standard as 100% full load continuous, 125% full load for two hours, or 200% full load for one minute. Frequent use of the one minute, 200% full-load rating and repeated mo-

FIG. 2-TYPICAL EFFICIENCIES OF DC CONVERSION EQUIPMENT





mentary current peaks above nameplate rating usually results in excessive brush and commutator maintenance requirements. In addition, the peak momentary current-carrying capacity of the motor-generator set is limited primarily by the generator commutating ability and the maximum torque of the driving motor.

In motor-generator sets, losses consist of iron and copper losses, plus windage and bearing-friction losses, which are associated with all rotating equipment. Friction losses, and iron losses to a lesser degree, are nearly constant and independent of the generator load. This accounts for the low light-load efficiency of the motor-generator set as shown by Fig. 2.

The rotating nature of the motor-generator set requires a relatively elaborate and sometimes expensive installation to insure correct bearing alignment and adequate foundation. Any vibration attendant with its operation results in brush, commutator and bearing difficulties. Consequently, most sets are installed with provisions for bolting the baseplate of the machine to a concrete base. A typical installation is shown in an accompanying photo.

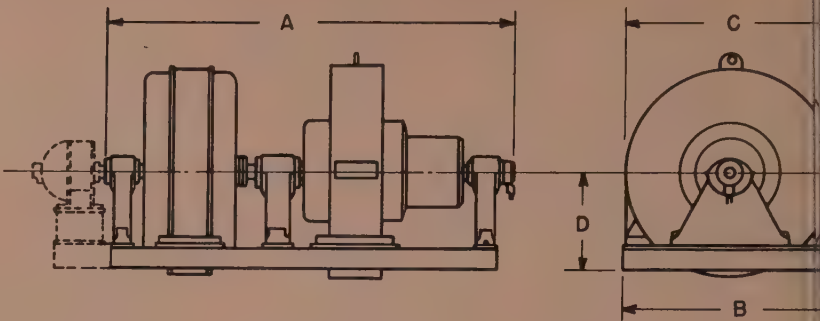
Maintenance requirements of motor-generator sets are well established and consist primarily of brush and commutator care, bearing lubrication, and periodic cleaning to maintain insulation at the required level. Periodic shutdowns are required to perform these maintenance functions.

Rotary Converter

The synchronous or rotary converter combines in one machine the essential characteristics of an ac synchronous motor and a dc generator. This is accomplished by utilizing one armature winding on the rotor of the machine and by providing collector rings for ac input on one end of the rotor and at the other end, a commutator for dc output.

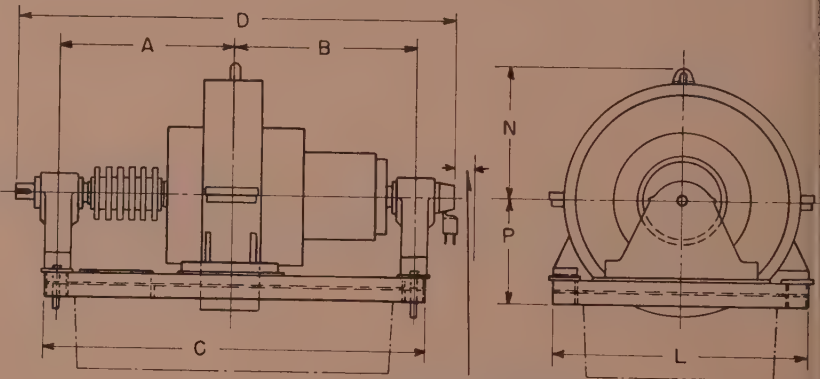
The field poles are similar in construction to those of a dc generator, except that they are provided with a damper winding for ac starting and operating stability. Most converters for industrial duty are furnished compound wound with shunt-field coils connected for self-excitation. The series field, which is suitable for flat compounding,

FIG.3- SPECIFICATIONS FOR TYPICAL MOTOR GENERATOR SETS



| MG SET |      | MOTOR      |      | POLES |      | DIMENSIONS (INCHES) |    |    |    | APPROX. V<br>IN LBS. |
|--------|------|------------|------|-------|------|---------------------|----|----|----|----------------------|
| KW.    | RPM. | VOLTS      | HP   | MOTOR | GEN. | A                   | B  | C  | D  |                      |
| 500    | 900  | 440-7000   | 725  | 8     | 4    | 149                 | 66 | 62 | 27 | 22 100               |
| 750    | 900  | 2200-14000 | 1100 | 8     | 6    | 169                 | 90 | 80 | 28 | 32 000               |
| 1000   | 720  | 2200-14000 | 1450 | 10    | 8    | 180                 | 90 | 80 | 30 | 39 600               |

FIG.4- SPECIFICATIONS FOR TYPICAL ROTARY CONVERTERS



A MIN. CLEARANCE  
OF 6" REQUIRED FOR  
REMOVING S.L. DEVICE.

| UNIT | KW   | VOLTS DC | PHASE | CYCLES | RPM  |
|------|------|----------|-------|--------|------|
| (a)  | 500  | 250      | 6     | 60     | 1200 |
| (b)  | 750  | 250      | 6     | 60     | 900  |
| (c)  | 1000 | 250      | 6     | 60     | 900  |

| UNIT | APPROXIMATE DIMENSIONS CORRESPONDING<br>TO LETTERS IN OUTLINE VIEW (INCHES) |    |     |     |    |    |    | APPROXIMATE NET W<br>LBS. |        |
|------|-----------------------------------------------------------------------------|----|-----|-----|----|----|----|---------------------------|--------|
|      | A                                                                           | B  | C   | D   | L  | N  | P  | REVOLVING<br>PARTS        | TOTAL  |
| (a)  | 41                                                                          | 40 | 87  | 102 | 52 | 27 | 27 | 4300                      | 12 250 |
| (b)  | 51                                                                          | 44 | 104 | 118 | 72 | 34 | 31 | 7200                      | 19 500 |
| (c)  | 54                                                                          | 47 | 110 | 124 | 72 | 51 | 31 | 8500                      | 24 000 |

has provisions for external adjustment of the series field strength.

The dc output voltage of a rotary converter is a direct ratio of the ac voltage supplied to the slip rings. Consequently, any variation in the system supply voltage results in a

proportional change in the dc output voltage. Transformers are used to supply voltage of the correct value for rated dc voltage output, as well as to provide reduced voltage for starting. Since the

(Continued on page 207)



# Analyzing Reported Costs Of Proposed Projects

## PART II - Material and Labor Costs

By Ray Ashley, Research and Consulting Engineer, Oak Park, Ill.

### STATEMENT:

The value of preliminary studies and the need for an estimator to be able to analyze reported costs for electrical work were discussed in a previous article (pg. 90, August, 1962, El C&M). Here, we shall analyze a specific project for which the estimated

cost of the electrical work is known.

The project is a 10-story office building with seven typical floors. The contract price for the electrical work is estimated to be \$600,000. The prevailing wage rate for electricians is \$4.00 per hour.

**QUESTIONS:** *What approximate values will an analysis of this specific electrical project reveal for:*

1. *Base Cost of the Project (purchase price of material and labor payroll)?*
2. *Base Cost of Material (purchase price)?*
3. *Base Cost of Labor (payroll)?*
4. *Total Job Labor (man-hours)?*

- ANSWERS:**
1. *A \$480,000 base job cost.*
  2. *A \$288,000 base cost of material.*
  3. *A \$192,000 base labor cost.*
  4. *A total of 48,000 man-hours for job labor.*

### DISCUSSION:

To get the answers, refer to the multipliers in Fig. 1 applicable to a \$600,000 project. This table was first presented and explained in Es-  
(Continued on Page 174)

**FIG. 1—Multipliers Applied to Contract Price**

For Complete Installations with 60/40 MLR and \$4.00 per hr. Labor Rate

| CONTRACT<br>PRICE<br>(Dollars) | MARKUPS USED    |     |      |                  |     |      |      | MULTIPLIERS<br>(Unit × Contract Price) |                       |                    |                | HOURS<br>LABOR |
|--------------------------------|-----------------|-----|------|------------------|-----|------|------|----------------------------------------|-----------------------|--------------------|----------------|----------------|
|                                | MATERIAL MU (%) |     |      | LABOR MARKUP (%) |     |      |      | Base Cost<br>THE JOB                   | Base Cost<br>MATERIAL | Base Cost<br>LABOR | LABOR<br>HOURS |                |
|                                | DJC             | OH* | RET. | DJC              | OH* | INS. | RET. |                                        |                       |                    |                |                |
| 1                              | 2               | 3   | 4    | 5                | 6   | 7    | 8    | 9                                      | 10                    | 11                 | 12             | 13             |
| 7,000                          | 3               | 10  | 8    | 8                | 35  | 10   | 10   | 0.704                                  | 0.422                 | 0.282              | 0.071          | 500            |
| 13,500                         | 3               | 8   | 6    | 7                | 28  | 10   | 10   | 0.741                                  | 0.445                 | 0.297              | 0.074          | 1,000          |
| 26,200                         | 2               | 7   | 5    | 6                | 25  | 10   | 10   | 0.765                                  | 0.458                 | 0.307              | 0.077          | 2,000          |
| 39,000                         | 2               | 7   | 5    | 6                | 22  | 10   | 10   | 0.770                                  | 0.462                 | 0.308              | 0.077          | 3,000          |
| 64,500                         | 2               | 6   | 5    | 6                | 20  | 10   | 10   | 0.776                                  | 0.466                 | 0.310              | 0.078          | 5,000          |
| 96,000                         | 2               | 5   | 5    | 6                | 18  | 10   | 10   | 0.782                                  | 0.468                 | 0.313              | 0.078          | 7,500          |
| 127,000                        | 2               | 5   | 5    | 6                | 17  | 10   | 10   | 0.788                                  | 0.474                 | 0.315              | 0.079          | 10,000         |
| 315,000                        | 2               | 5   | 5    | 6                | 15  | 10   | 10   | 0.794                                  | 0.476                 | 0.318              | 0.080          | 25,000         |
| 625,000                        | 2               | 4   | 5    | 6                | 14  | 10   | 10   | 0.800                                  | 0.480                 | 0.320              | 0.080          | 50,000         |
| 930,000                        | 2               | 4   | 5    | 6                | 13  | 10   | 10   | 0.806                                  | 0.485                 | 0.322              | 0.081          | 75,000         |

**Abbreviations:**

DJC—Direct Job Costs  
INS.—Insurance  
OH—Overhead

MLR—Material-Labor Ratio  
MU—Markups  
RET.—Return (Anticipated Profit)

\*—Overhead values from "Electrical Contracting," McGraw-Hill Book Co.





**WASATCH ELECTRIC** equipped truck with special vertical-lift platform to permit men to work safely at 30-ft height while installing and connecting 3-fixture lighting assemblies atop poles.



**SALT LAKE CITY'S** new Main St. lighting provides average pavement illumination of 4.5 footcandles; 5 times former lighting level although current consumption is 8% less.

## Salt Lake City Ups Main Street Lighting

**S**ALT LAKE CITY'S Main Street now ranks among the country's most brightly lighted commercial thoroughfares since new street lighting equipment has been installed. Three luminaires, arranged in a T-shaped pattern with a combined output of 87,000 lumens of fluorescent lighting, are mounted on each of 70 rebuilt and modified street lighting standards which, for 45 years, supported carbon-arc fixtures. The new installation increases illumination levels while cutting power requirements 8%.

Difficulties in obtaining carbons and replacement parts for the obsolete arc lamps dictated a change. An experimental installation of the fluorescent fixtures, compared with others using mercury-vapor lamps and incandescent lamps, gained the most public favor.

Wasatch Electric Co., Salt Lake City, won the contract. The project involved 70 street lighting standards, 14 per block, spaced 107 ft apart. Luminaires are mounted 34 ft above the street, one tilted slightly upward over the street and

the others parallel to the curb. The outer fixtures have four 6-ft, 1500-ma lamps and operate on 240-volt circuits. The other fixtures have two lamps each operated on 120-volt circuits. Lighting levels now average 4.5 fc, a five-fold increase over the former 0.9 fc.

Two circuits serve each pole. A 240-volt circuit supplies the outer fixture and is switched by a magnetic contactor operated by a photocell device. A 120-volt circuit supplies the two other fixtures and a receptacle for connecting seasonal lighting displays. This circuit is operated by a time switch which turns it off at midnight.

Utah Power and Light Co. supplies power from existing vaults located under the sidewalk. Existing underground conduits and pole bases were also reused.

The existing poles, which once also supported trolley wires, were modified. They were cut off, just above the curb line by means of an acetylene torch and removed to the contractor's shop. There 11-ft extensions of 6-in. steel pipe were

welded on bringing the height to 34 ft. An inner sleeve was welded to the bottom. After sandblasting and a primer coat each pole was returned to its original location and installed on the old base. Concrete around the base was removed to a depth of about a foot. On erection the inner sleeve aligned the pole with the base. The joint was then butt-welded. An outer sleeve, to give additional protection against corrosion at the bottom of the pole, was dropped over the joint and welded in place. New concrete was then poured around the base and the poles were painted with aluminum paint to provide suitable protection from corrosion.

The electrical contract amounted to \$97,000, slightly less than \$16 per front foot. Power costs run \$144 per pole annually or about \$1.70 per front foot and are shared 75% is paid by the merchants and 25% by the city. The pole receptacles for seasonal lighting are expected to save the merchants about \$1300 and the utility about \$600 annually.



## Voltage Regulation for Electronic Equipment

At Todd Shipyard, Brooklyn, N.Y., a special problem in voltage regulation threatened to defeat maintenance operations for an incoming ship. Because the ship is an experimental antimissile ship laden with electronic and radar equipment, its power distribution system provides a nearly constant voltage regulated at plus or minus 1½%. However, when in the shipyard, the ship's power supply would be down for maintenance. And because testing of the electronic equipment was scheduled, the shipyard had to have available the regulated voltage required. But at the shipyard, the utility supply voltage varied nearly 3%.

In addition, the shipboard power feeding regulation was nearly 700 v. Because the ship was due into the shipyard in three weeks, the engineers at Todd were faced with the problem of obtaining a large regulator in a relatively short time. A custom builder of rectifiers in New York City promised to deliver a voltage regulator (700 kva, 3 phase, 460 volts, regulated at plus or minus

1½%) before the ship arrived in three weeks. And, in 19 days the unit was designed, constructed, tested and delivered to the shipyard ready for operation.

Major voltage regulator components include three 35-kva buck or boost transformers, 18 8-kva variable autotransformers, 12 special balancing reactors, a motor and chain-drive assembly, and an electronic sensing controller.

Constructed of 18 gauge, gray enameled sheet metal, steel angle and "I" beams, the frame measures 60 in. deep, 72 in. wide and 74 in. high. The variable autotransformers are mounted vertically on rotating shafts, six to each shaft. Located adjacent to the autotransformers, the buck or boost transformers require three 250 MCM conductors per leg on the line side to carry approximately 800 amps. The control unit is located behind the front panel, which is equipped with a voltmeter, ammeter, automatic-manual switch, voltage-adjust setting control and a sensitivity adjust.

Fig. 1 shows regulator operation. The sensing transformer feeds back a portion of the line voltage to the



**VOLTAGE REGULATOR**, rated 700 kva, 460 volts, 3 phase can provide regulation within plus or minus one-half of 1%. Operation is entirely automatic. Switch on control panel allows manual operation.

electronic sensing controller. When a voltage deviation occurs, the controller will then cause the motorized autotransformer voltage output to increase or decrease whichever is needed. At the same time, this autotransformer output voltage is being applied to the control windings of the buck or boost transformers, which will then add or subtract to the line voltage as required.

Regulation is quite accurate because the controller is essentially a balanced-bridge circuit, which can sense small voltage changes. A portion of the line voltage is impressed across one leg to the bridge. If a difference between these two voltages occurs, the electron tubes will amplify the difference voltage to operate either a "raise" or "lower" relay. These relays control direction of the motorized assembly that drives the variable autotransformers.

The drive unit consists of the motor coupled directly to six autotransformers and a sprocket and chain assembly coupled to the remaining 12 autotransformers (six paralleled autotransformers per leg are Y-connected).

Balancing reactors are installed to reduce any circulating currents that may occur if the sliding contacts on each autotransformer are not in perfect relationship to each other. Because of self-inductance, these reactors will oppose any unbalance current that attempts to flow.

Autotransformer output voltage is applied across the control windings of the 35-kva buck or boost transformers. These transformers,

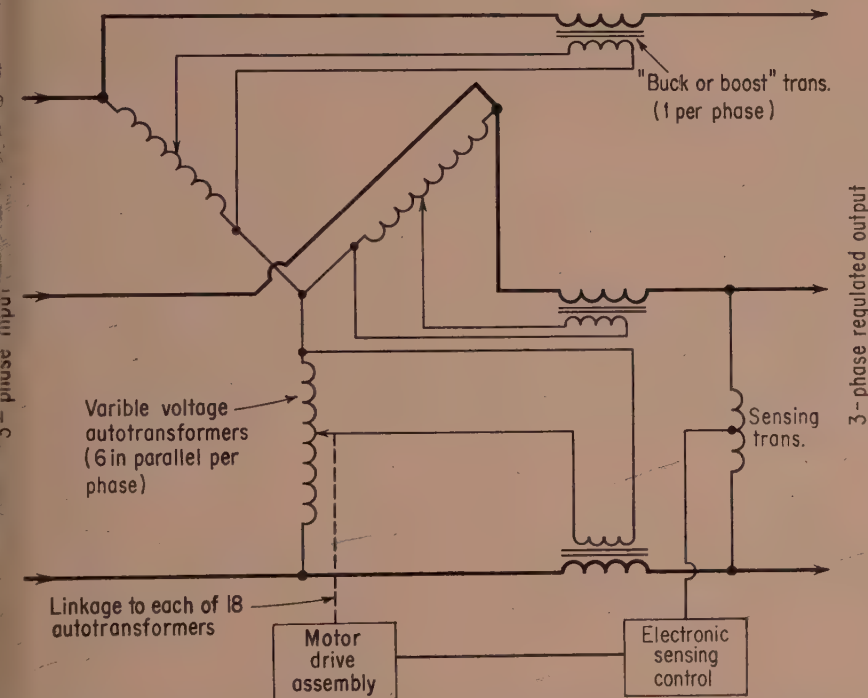
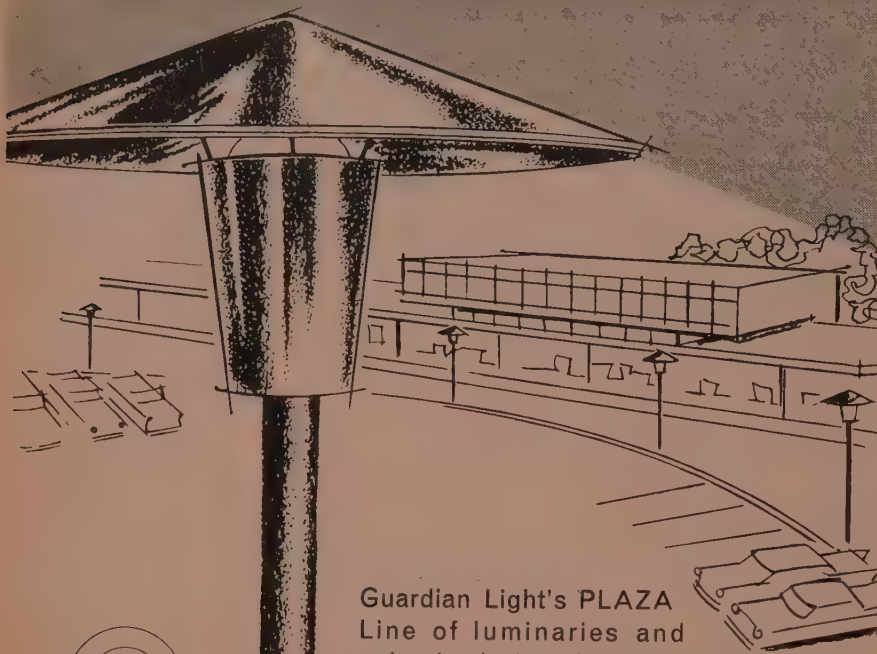


**FIG. 1**—One-line diagram shows how the voltage regulator operates. From the sensing transformer, a portion of the line voltage is fed back to the electronic controller where it is compared to a reference voltage. If a voltage variation occurs, the controller operates the motor assembly causing the variable autotransformer output voltage to increase or decrease whichever is needed. At the same time, this autotransformer output voltage is applied to the control winding of the buck or boost transformers, which then add or subtract to the line voltage as required.



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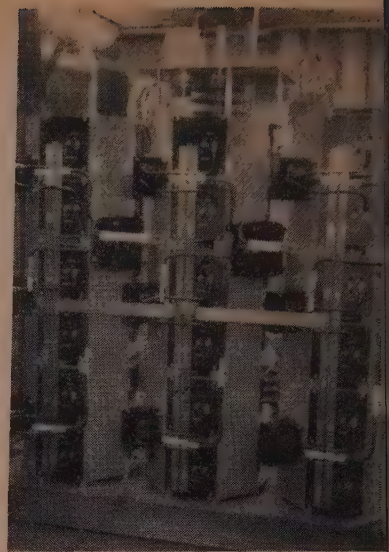


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arranged six per phase. In each leg, 8-kva autotransformers are mounted on a common shaft which is chain-coupled to the motor drive assembly. Mounted on the autotransformer frames, iron-core balancing reactors will oppose any balance autotransformer circulating current.

connected in each phase, add or subtract to the line voltage as required.

This type of regulator may have many versatile applications. For example, it has desirable characteristics for use in conjunction with electronic equipment, computer and laboratory installations as well as normal voltage regulator applications in industry. Distinguishing characteristics include: no waveform distortion, high efficiency, effect on power factor, close regulation, ability to withstand high overloads, simple maintenance, and, because of its comparatively light weight, portability.

## 200-FC Installation Economically Justified

A cryptic case history of a 200- industrial lighting installation in southern California can be summarized briefly by citing successive reactions of management when the (a) first saw the lighting plan, (b) first saw the completed installation (c) first saw the increased utility bill and (d) finally equated costs and charges to values obtained. The specific installation pertains to the Allied Pacific Mfg. Co., Compton, Calif., yet reactions are typical of those evidenced in numerous similar instances.

Initial reaction upon studying costs related to this 217-luminaire installation was "skepticism resul





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**AVERAGE INTENSITIES** of 200-fc are obtained at working planes, while higher values are achieved in certain areas of critical importance by additional local lighting fixtures. Upward lighting component of 12% minimizes contrasts between luminaires and overhead surrounds, while high-reflectance painted room surfaces and progressive lighting maintenance program insures long-range returns on this investment. Measurable returns in forms of higher output and lower spoilage due to product rejection amortized cost of installation within eight months.

ing in reluctant approval,” for management had considered 60-fc lighting in a former plant “adequate” and this proposed 200-fc installation exceeded their tentative budget considerably. In addition, management was being asked simultaneously to consider additional expenditures for high-reflectance painting and a long-range lighting maintenance program. Approval was obtained after considerable education and promotion on the parts of Twombly Consulting Engineers and Southern Calif. Edison lighting engineer Melvin V. Paul.

The second reaction was “reluctant satisfaction” when, immediately upon completion of the job, footcandle readings taken at waist level averaged 205. After benches and machines had been positioned these initial readings dropped to about 180, although, after painting recommendations had been followed and color values lightened, the calculated and predicted value of 200-fc was achieved exactly.

The third reaction was “incredulous indignation” when the first utility bill was received; a reaction which placed designers in the unenviable position of defending a well-conceived plan.

But defend it they did—by requesting, obtaining and equating old and new data related to production output, material spoilage and rejects, absentee statistics and employee reactions. In all instances, results were up noticeably and meas-

urably. And, when those factors which could be translated into terms of hard dollars were evaluated, indications were that the installation (including initial costs plus increased utility charges) would be amortized from savings within ten months. This prediction was in error by 20%, because the installation actually paid for itself in eight months.

The final reaction was one of “enthusiastic endorsement” because, as voluntarily testified by Allied president Donald Stull, “The new lighting has become an important working tool; a sound investment resulting in increased production over-all plant efficiency and employee morale. Moreover, customers comment favorably upon the clean, modern appearance of our plant, and it is our considered opinion that good lighting is a very tangible business asset.”

As to physical details, 217 industrial 3-lamp luminaires are installed in continuous rows on 10-ft centers at a height of 12 ft above the floor to illuminate a new 17,000-sq ft irregularly shaped machine shop. Lamps are 8-ft cool-white rapid-start T-12 fluorescents operating at 800-ma and wired in tandem to 2-lamp ballasts. Slotted canopies permit an upward lighting component of 12% to minimize brightness contrasts between fixtures and overhead surrounds, while all room surfaces are matte finish having reflectance values between 65%, (for ceiling and upper walls) and 35%





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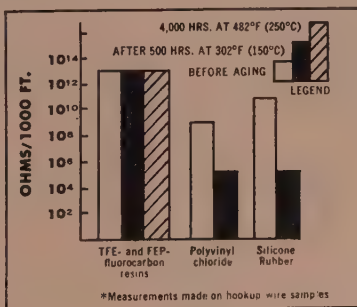
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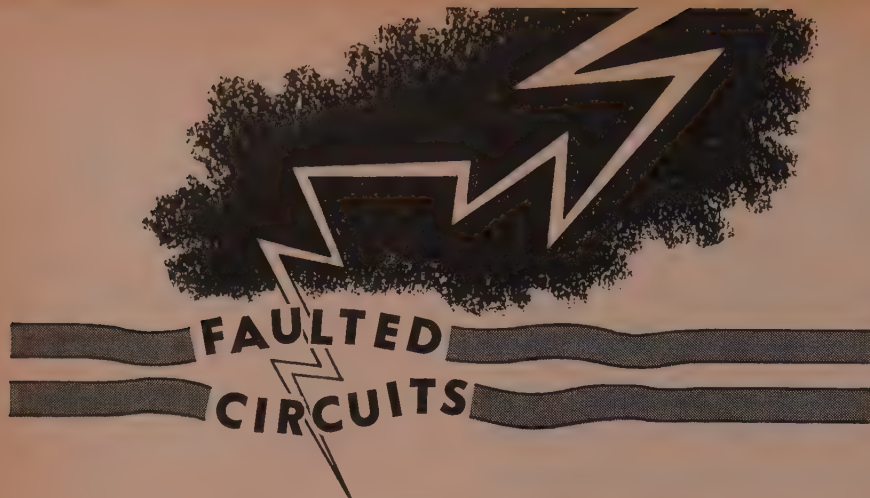
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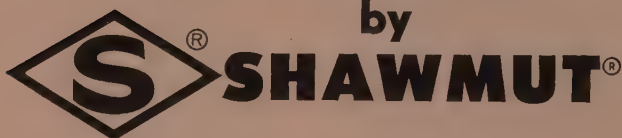
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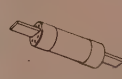
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(for cement floor). Brightness ratios between typical tasks and reflector exteriors average 1-to-1; between tasks and benchtops 3:1; between tasks and walls 2:1; between tasks and ceiling 2½:1; between walls and ceiling 4:1, and between tasks and reflector interiors 1:1. This maximum ratio, however, would not normally be experienced without looking directly up at lamps.

Relating this installation to "normal" machine shops, it may be stated that illumination values and brightness ratios are commendable. And, when it is added that this design was prepared, submitted and approved prior to the Blackwell report, the calibre of the installation is impressive.

### Facts About Electric Shock

The only difference between receiving a minor electric shock, and the shock of your life (the last one that is) is a matter of circumstance. The following should be "must" reading for anyone who works around electrical equipment—and who would like to stay around. It is an explanation of the effects of electricity on the human body.

Electricity kills by overriding the control the nervous system exercises over the various vital organs including the heart and the brain.

The brain sends instructions to the controlled parts of the body via an intricate electro-chemical network we know as the nervous system. If overridden by an outside source, the electrical impulses of the nervous system lose control of body functions.

The uncontrolled currents that flow during electrical shock swamp out the signals going to various parts of the body. Particularly dangerous are such currents that enter the heart and respiratory centers. Thus, a key factor in death by electrical shock is the path of the undesired current within the human body, as well as its amperage and voltage.

Death following shock is generally caused by one of two direct effects: ventricular fibrillation or respiratory-center paralysis.

To understand ventricular fibrillation, we should know a little about how the heart operates. Controlling the heart muscles is a minute, electric current occurring periodically in the right auricle of that organ. If the conduction system of

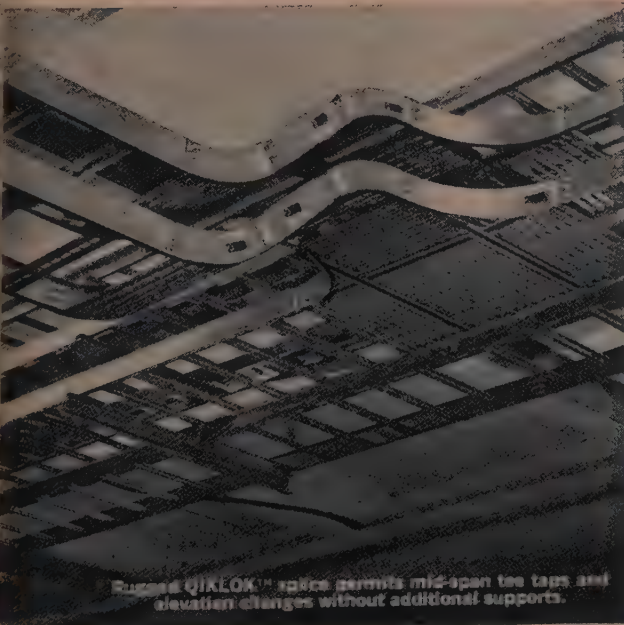


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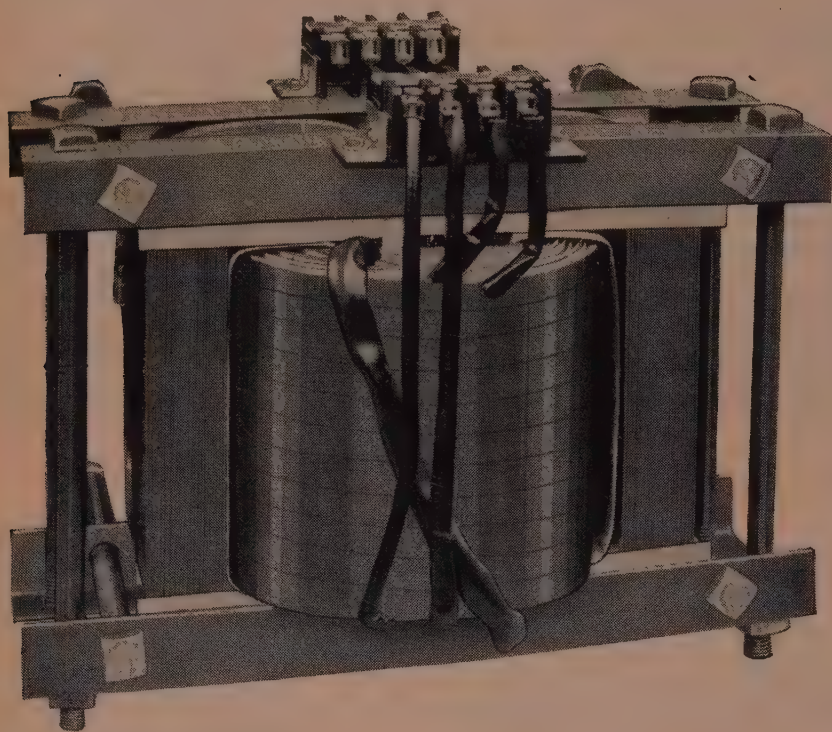
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**DONGAN DRY-TYPE TRANSFORMERS** are made in both class B 80° Cent. Rise and Class H 150° Cent. Rise. Single phase transformers, 25 V.A. to 100 KVA; three phase, 3 KVA to 300 KVA. Suitable for indoor or outdoor applications. Designed for wall or platform mounting. All have roomy wiring compartments.

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the heart is disturbed, say by outside electric current, the muscles respond in a haphazard fashion rendering the organ useless as a pump. Known as a ventricular fibrillation, this phenomenon generally causes death since the body organs are not supplied with fresh blood.

Respiratory-center paralysis is the second most lethal effect of electrical shock. Normal breathing is controlled by a stimulus from a portion of the brain. The electrical stimulus travels through a complex nerve network to the breathing muscles and lungs. An outside current can easily paralyze the network and cause breathing to stop. Actually death from shock can be caused by respiratory-center paralysis, by ventricular fibrillation or by both.

For obvious reasons, the exact intensity of current that will cause death in a human being is not easy to determine. The following table presents key information, and will serve as an illustrative guide.

### Shock Current Intensities and Their Effects

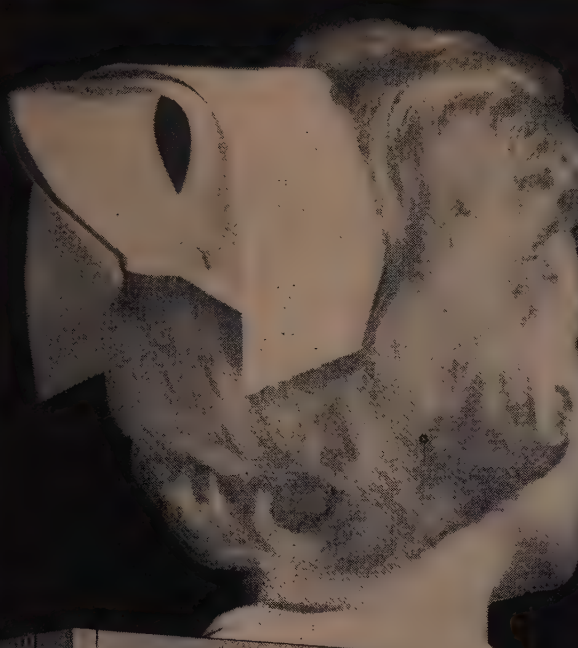
| Current in Amperes* | Effect                                                    |
|---------------------|-----------------------------------------------------------|
| .001-.008           | Sensations.                                               |
| .008-.015           | Painful shock for most people.                            |
| .015-.019           | Paralysis of muscles through which current flows.         |
| .020-.050           | Possible permanent damage to tissues and blood vessels.   |
| .050-.100           | May be lethal. Certain fibrillation of the heart —lethal. |

\*The current required to operate a 10-watt bulb on 115-volt house current is .087 amp.

Currents of .07 to .09 amps generally cause death by ventricular fibrillation, if they pass through the chest. However, much lower currents can also prove fatal. A current of only .015 amp passing directly through the chest can render the victim incapable of releasing himself from the circuit, while simultaneously paralyzing the muscles of the diaphragm needed in breathing. Unless he is released from the circuit with outside help he will die from asphyxia even though the heart and respiratory centers are not affected directly.

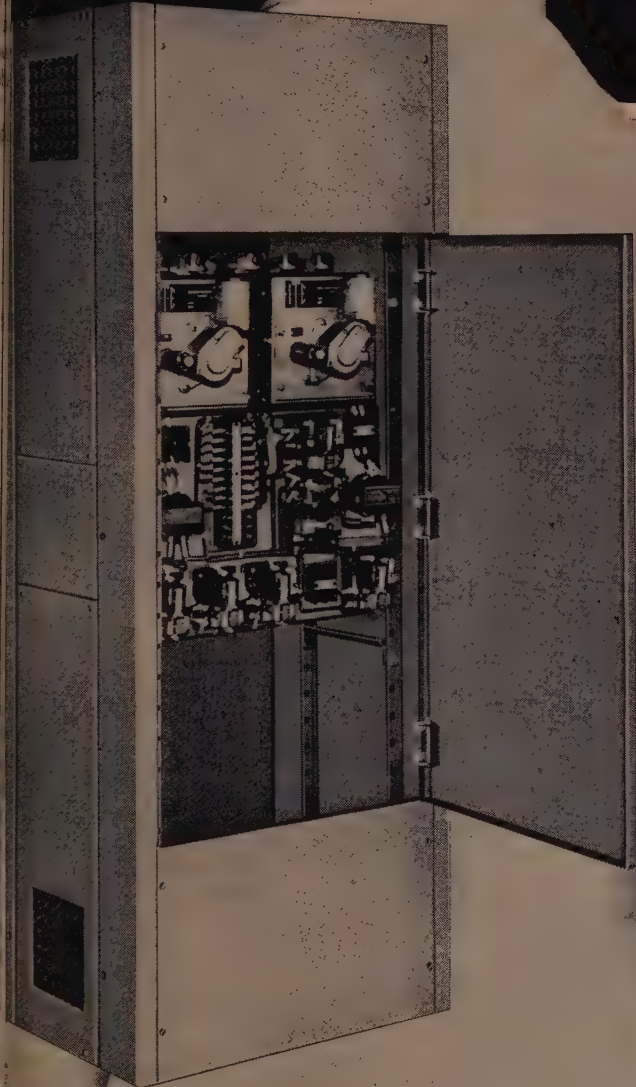
Thus far we have considered only the effects of a current passing through the body. However, voltage is the force that determines





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The TELEMANT AUTOMATIC TRANSFER UNIT makes available thermal overload protection, higher interrupting capacity, and positive protection against transferring into a fault or overload condition.

The exclusive design I-T-E TELEMANT motor drive is industry's first really satisfactory answer to remote control of molded case circuit breakers. Rugged construction of the motor drive has been proved by testing through 10,000 operating cycles without breakdown or visible signs of wear.

**Always specify I-T-E dependable quality. I-T-E products are for the engineers and contractors who are proud of their work.**

FOR ADDITIONAL INFORMATION contact your nearest I-T-E sales office or write I-T-E Circuit Breaker Company, 125 Bennett St., N.W., Atlanta 9, Georgia. Request Descriptive Bulletin 9000-1A.



## I-T-E CIRCUIT BREAKER COMPANY

WALKER DIVISION



NEW \$11,000,000. APARTMENT

# Keeps Pace Electrically..

*with Safety!*





# BUSS Fuses safeguard Electrical System of Miami Beach's new 550-unit Southgate Towers Apartments

This super apartment building in Miami Beach on Biscayne Bay near Tenth Street contains 550 apartments in its twin 14 story towers.

For guests to be able to enjoy the many advantages of modern electric living,—an electrical system with great capacity was installed.

There are four electrical service entrances,—the largest of which has an estimated available fault current of 93,000 amperes.

The safest, most dependable protection against available fault currents is assured by equipping the main panel board and feeder circuits with BUSS Hi-Cap and Buss LIMITRON fuses.

Further, the electrical system can grow and the fuses have an interrupting rating sufficient to handle the increase in available fault current.

The interrupting rating for BUSS Hi-Cap and Buss LIMITRON fuses is 200,000 amps. rms symmetrical.

## *Steadily Growing Power Requirements Re-emphasizes the Advantages of BUSS Fuses*

With available fault currents reaching 75,000 to 200,000 amps.—safe, dependable interruption of fault currents is essential to guard against ruined equipment, danger of fire and possible injury to personnel.

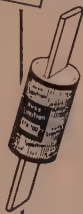
To meet this demand for safety,—BUSS developed high interrupting capacity fuses with specific characteristics to meet your requirements. For example:



### **BUSS Hi-Cap Fuses**

For loads above 600 and up to 6,000 amps. Have 200,000 amp. interrupting rating. High speed operation limits fault currents to safe values.

Ask for Bulletin HCS.



### **BUSS LIMITRON Fuses**

Have 200,000 amp. interrupting rating. Extremely fast opening characteristics prevent heavy short circuit currents building up under fault conditions.

Ask for Bulletin HLS.



### **BUSS LOW-PEAK Fuses**

A great advancement in protective devices. Have 200,000 amp. interrupting rating... provide great current limitation... plus long time-lag to prevent needless shutdowns.

Ask for Bulletin LPCS.

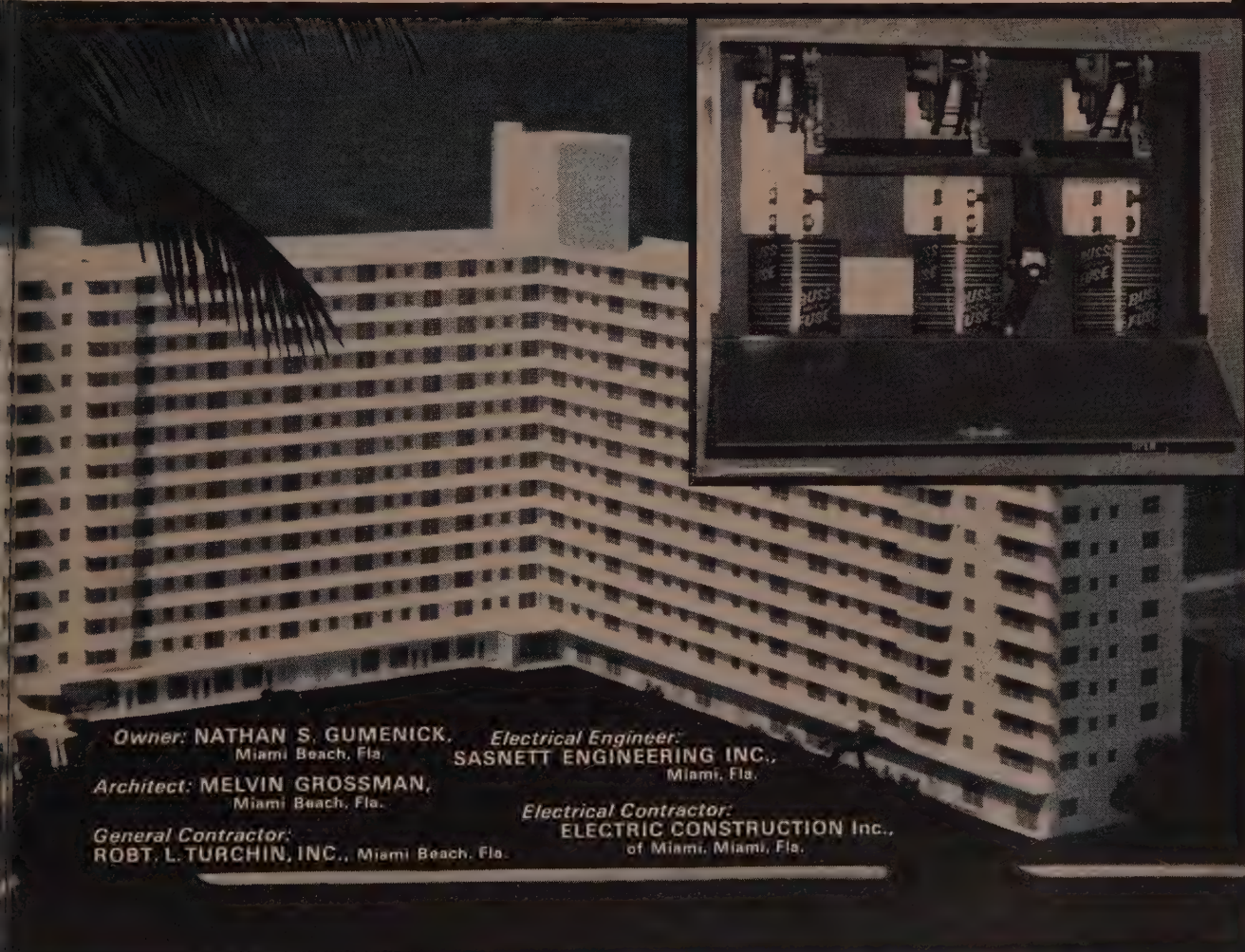


### **FUSETRON dual-element Fuses**

All purpose protective device for circuits, motor or equipment protection. Have 100,000 amp. interrupting rating.

Ask for Bulletin FIS.

**BUSSMANN MFG. DIVISION McGraw-Edison Co.**  
St. Louis 7, Mo.



**Owner: NATHAN S. GUMENICK,**  
Miami Beach, Fla.

**Electrical Engineer:**  
**SASNETT ENGINEERING INC.,**  
Miami, Fla.

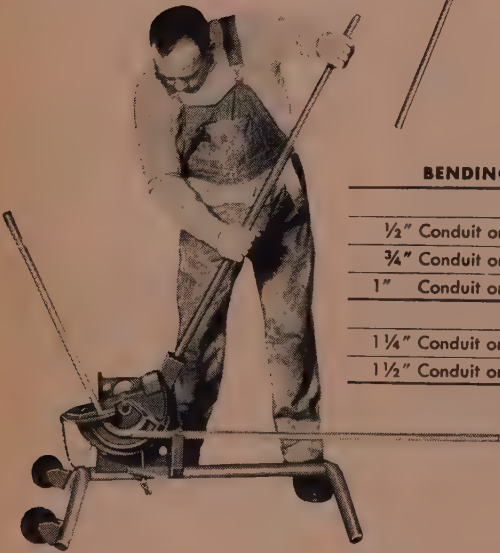
**Architect: MELVIN GROSSMAN,**  
Miami Beach, Fla.

**General Contractor:**  
**ROBT. L. TURCHIN, INC.,** Miami Beach, Fla.

**Electrical Contractor:**  
**ELECTRIC CONSTRUCTION Inc.,**  
of Miami, Miami, Fla.



try this  
**BENDER**  
on for size



BENDING CIRCLES—INSIDE RADIUS

|                        | *No. 5100 | No. 5300 |
|------------------------|-----------|----------|
| 1/2" Conduit or Pipe   | 2 3/16"   | EMT 4"   |
| 3/4" Conduit or Pipe   | 4 1/8"    | EMT 5"   |
| 1" Conduit or Pipe     | 5 1/4"    | EMT 6"   |
|                        | No. 5200  | No. 5400 |
| 1 1/4" Conduit or Pipe | 6 7/8"    | EMT 8"   |
| 1 1/2" Conduit or Pipe | 8 1/4"    | EMT 10"  |

\*Illustrated

## pipe extends legs for any height desired

Now . . . you can have the most convenient working height when you need it . . . where you need it.

For **SIZE . . . WEIGHT and HEIGHT** you won't find another bender that will compare with the on-the-job capabilities of the Lidseen "Chicago" Bender. This rugged, portable, simplified machine is of all welded steel construction. There are no loose parts to be lost or misplaced and the only maintenance is an occasional drop of oil. This improved Lidseen Bender is lighter in weight, at least twice as fast as hydraulic and **bends Aluminum or Steel Conduit equally well.** And Price? Eminently reasonable . . . ask the electrician who is using one; he will tell you it's the finest tool available.



Write for **NEW** folder on  
*How to Bend Conduit*

**LIDSEEN** OF NORTH CAROLINA, INC.  
1050 FIRST STREET, HAYESVILLE  
NORTH CAROLINA

current magnitude. The amount of current for a given applied voltage of course, depends on resistance and the resistance of the human body varies widely. It depends among other things, upon the amount of current, the health of the individual, the duration of the current flow, the condition of the skin (dry, etc.) and the area of contact.

While perspiring freely on a warm day, the resistance is so low that 40 volts could produce sufficient current to cause death. Confirming this, there are cases on record of deaths caused by 32-volt farm lighting system.

Not only the voltage and current magnitude but also the current body paths are important. A route involving the heart or brain is dangerous. In a number of cases involving fatal shock at voltages as low as 250, 90% of the victims had marks on their left hands. This indicates that shocks through the left hand—hence, nearer the left side of the heart—are more dangerous than those through the right hand.

**WHAT TO DO**—What should you do if you see someone rendered unconscious by electric shock?

Every person who works near electrical equipment should be familiar with rescue techniques.

The first step is to break the connection between the victim and the power source. If possible, do this by turning off the power. The next best thing is to remove the victim from the voltage source—without endangering yourself. Use a wooden board or other non-conducting object. As soon as you can touch the victim safely, apply artificial respiration. The mouth-to-mouth method is the most effective.

Speed is essential. Any delay greatly reduces the chances of recovery. Of some 600 cases studied, over 70% of those receiving artificial respiration within three minutes recovered. Just one minute of delay dropped the figure to 58%. If there is no heart or respiratory action and treatment is delayed five minutes, death is virtually certain.

If you are alone, do not take time to go for help. Start artificial respiration immediately. If the person can be saved, you can do it as well as anyone. And don't stop even if the victim appears dead. Eight hours have elapsed, in some cases, before victims responded. The only sure sign of death is rigor mortis—and only a physician should judge whether that condition exists.

From the "Safety Newsletter" IBM Corp., Kingston, N. Y.

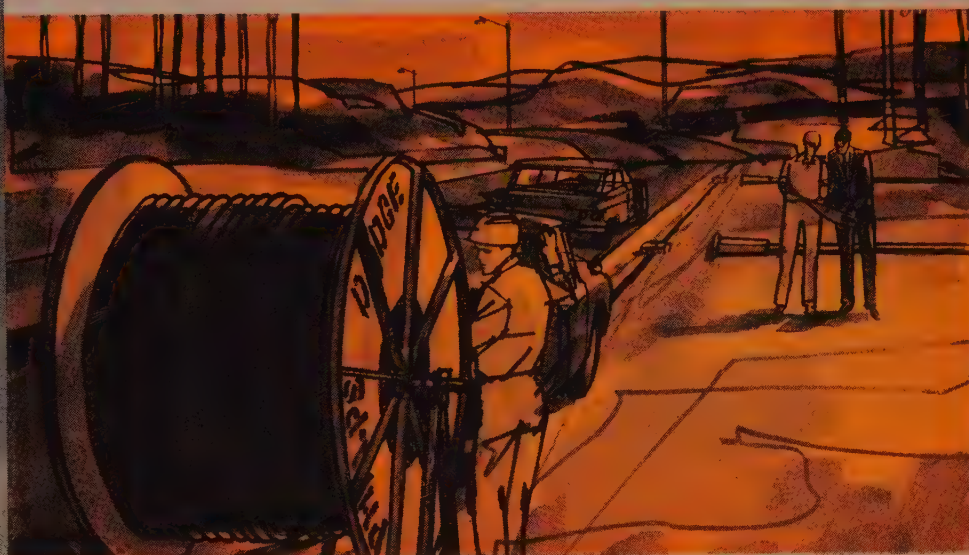




NEW FROM PHELPS DODGE...

**CDC**

Combined duct and cable in one unit



## Direct burial system substantially reduces original installation costs

Phelps Dodge now offers CDC, a new and advanced factory-assembled, plastic duct-enclosed cable for direct burial use. It retains all the advantages of standard duct construction but eliminates the costly time-consuming tasks of laying duct and pulling cable separately.

This Combined Duct-Cable unit design is particularly adaptable for use in Residential Underground

Distribution Circuits, Multiple Series Street & Highway Lighting Circuits and Underground Branch Feeder Circuits.

Designed for easy re-cabling, Phelps Dodge CDC has a high degree of system flexibility. Future load growth can be accommodated by proper initial duct-size selection. Conduit fill is in accordance with NEC standards averaging approximately 40% of conduit area.

See your Phelps Dodge representative for information about this new duct-cable unit.

**PHELPS DODGE COPPER PRODUCTS**

CORPORATION • 300 PARK AVENUE, NEW YORK 22, N. Y.





# NEW General Electric Transformer



GIVE YOU ...

**CORRECT  
PRIMARY  
TAPS**

... EVERY TIME

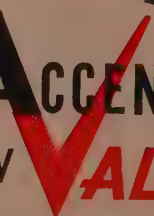
**SIX UNIVERSAL TAPS** are now provided on QHT transformers rated 30 kva and up. Taps are: four  $2\frac{1}{2}\%$  below normal and two  $2\frac{1}{2}\%$  above. This arrangement, a G-E "first", eliminates the problem of selecting from as many as three transformers with different primary tap ratings. Each QHT transformer covers a 15% range of tap voltage levels. You save ordering time, and you can use the same QHT transformer even if your line voltage levels change later on. **MAKE SURE YOU GET THE CORRECT PRIMARY TAPS FOR YOUR APPLICATION . . . SPECIFY NEW GENERAL ELECTRIC QHT DRY-TYPE TRANSFORMERS.** Get all the facts from your nearby G-E Sales Office or distributor. Or write Section 411-23, General Electric Co., Schenectady 5, N. Y.



*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**



**ACCENT**  
ON  **VALUE**



## Dynamic Balancer Promotes Sales and Prestige

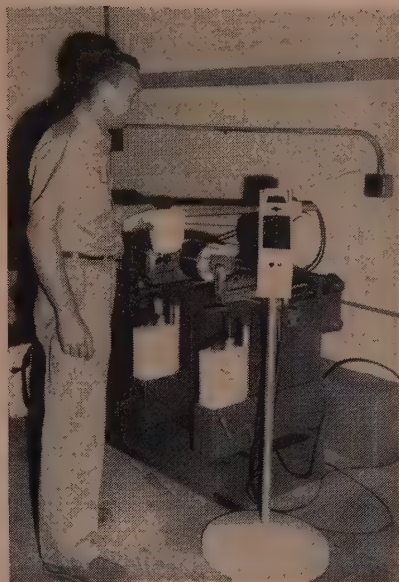
Modern equipment generally is considered as an investment in shop efficiency which can be measured by improved workmanship, better products, and labor savings. In the case of dynamic balancers, efficiency also can be measured by smoother running motors and generators, less noise, longer life. These benefits alone justify the purchase. In addition, however, such equipment can be justified as advertising or sales promotion investments, since modern equipment improves a shop's prestige and cultivates business.

This is the philosophy of L. J. Symmonds and William L. Casey, partner-owners of Electric Motor Co., Tucson, Ariz. Their philosophy is reflected in a shop stocked with quality materials and parts, kept clean to showcase their top-flight shop, and equipped with modern tools and machines.

The dynamic balancer is a case in point. It operates on the principle of resonance to detect unbalance at critical speeds. Detected vibration amplitudes are then translated into electrical impulses which may be read directly from meters. Positions and amounts of unbalance are located by a stroboscopic light beam. The balancer accepts all types of rotating components up to 500 lbs in weight, 44 in. in dia, 4½ ft in shaft length between cradle trunnion bearings.

When delivered to the above shop, the drive unit consisted of a 1725-rpm ½-hp, 115-volt, single-phase, single-speed motor. However, to obtain higher rotating speeds for testing rotors equipped with large diameter shafts, the motor was rewound as a 2-speed 115/230-volt drive.

Rotating elements under test are brought to desired speeds by means of a friction belt rotating around a drive sheave and a second sheave mounted on a pivoted drive arm. Speed is imparted to the test element merely by pressing the friction belt against the shaft or outer shell of the rotor, generator, impeller, or whatever the device being tested happens to be. Since no drive coupling is required, set-up time is reduced. When a variety of rotating elements are being tested suc-



**ROTOR BEING TESTED** for dynamic balance is rotated above critical speed by lowering drive arm and friction belt against rotor shaft. Drive belt is then raised, drive motor switched off. Rotor coasts through point where resonance occurs. Mechanical vibrations are detected by tunable pickup dashpots. Stroboscopic light beam locates exact position of unbalance. Weight correction is recorded on meter having sensitivity of 1/100 in.-oz.

cessively, these reductions in set-up time add up to a considerable time saving.

In testing, a rotor (for example) the drive belt is first pressed against the rotor's shaft until the rotor speed is higher than that attained in normal operation. The operator then raises the drive belt. This permits the rotor to gradually coast through its resonant peak. He also switches off the drive motor. This eliminates all vibrations except those being investigated. Therefore readings of meters are exact.

Upon completing the test, the rotor can be decelerated and stopped by reactivating the drive system, pressing the friction belt against the rotor shaft, then stopping the motor by switch-brake control.

Elements being tested are supported by trunnion bearings suspended from flat springs which realign themselves, regardless of diameters of shafts, or whether shafts are uniform in cross section or tapered. Bearings are supported by a cradle assembly; one member of which may be moved along a bed track to accommodate shafts of different lengths.

As a rotating element coasts through its critical speed at which resonance occurs, resulting mechanical vibrations are detected by a tunable electronic device which filters out all vibration frequencies except those for which the device has been preset. This detection unit has a time delay so that transient vibrations, such as those induced by passing trucks or nearby motors starting up, will not have an effect on the proper operation of signaling mechanism.

Mechanical vibration is measured electronically. Electrical impulses of proportionate amplitude trigger a strobe light beam which locates and indicates the exact position of unbalance. This equipment determines the critical speed at which resonance occurs, prescribes amount of required weight correction, and pinpoints the exact position where weight should be placed. Readings are to 1/100 in.-oz.

Strobe light, meters and switches are mounted in the same housing so the operator can read and control the balancer from one position. Tubes and electronic components used in this balancer are standard elements which can be obtained from local radio or TV shops. Replacements, adjustments and repairs are simplified by wiring diagrams supplied with the balancer.

While owners of the Electric Motor Co. purchased this item only to locate and correct vibration, they now emphasize that an important added benefit is the enhancement of their shop's reputation with customers.



**NO ONE** is a stranger at an EASA meeting agree (L to R): George McDaniels, Kufen Electric Motors, Inc., Warminster, Pa.; and Lynn R. Silver, C. W. Silver Co., Salt Lake City, Utah, during session break at recent EASA Convention in Chicago.



# WRAP-UP ALL YOUR SPlicing NEEDS

with only

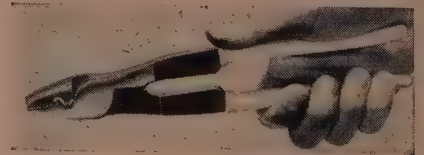
2

**IDEAL**

## CRIMP CONNECTORS

Ideal's two sizes of steel sleeves and WRAP-CAP "all-around" insulators will probably handle every splice you'll ever make. Listed for one #18 with one #14, to one #6 and two #8—1178 combinations in all!

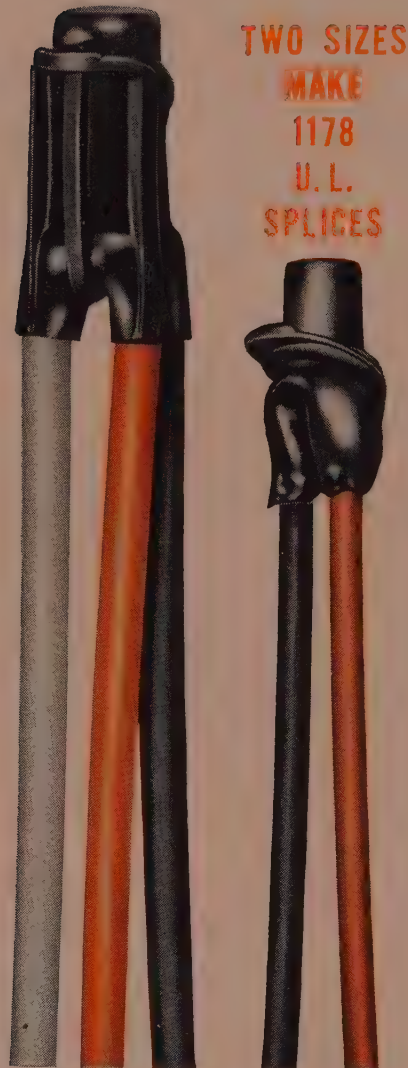
Greater holding power, too... greater than any other crimp connector used for pigtail splices. One-piece WRAP-CAP easily slides over even largest splice... completely insulates joint, even between wires. U.L. and C.S.A. listed for general use (600v) in branch circuit and fixture wiring, 1000v for signs and fixtures.



### New Crimp Tool—Makes Splicing Easier Than Ever Before!

Makes short work of even the largest crimps. A gentle, *one hand* squeeze and the job's done! Makes right-angle indents for tightest joints. Shear type cutter slices through toughest wire bundles; serrated nose grips, twists, deburrs—cleanly, easily. Replaces a whole pocketful of tools!

Sold through America's Leading Distributors  
In Canada: Irving Smith Ltd., Montreal



TWO SIZES  
MAKE  
1178  
U.L.  
SPLICES

IDEAL  
the helping  
hand on  
every  
wiring job.

**IDEAL INDUSTRIES, Inc.**

1041-I PARK AVENUE

SYCAMORE, ILLINOIS

**FREE SAMPLES!** Fill in and mail coupon. See how Ideal CRIMP CONNECTORS work—on big splices and small!

NAME \_\_\_\_\_

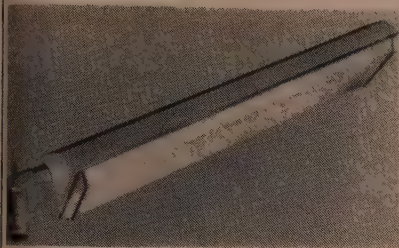
ADDRESS \_\_\_\_\_

COMPANY \_\_\_\_\_

CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_



# Product News

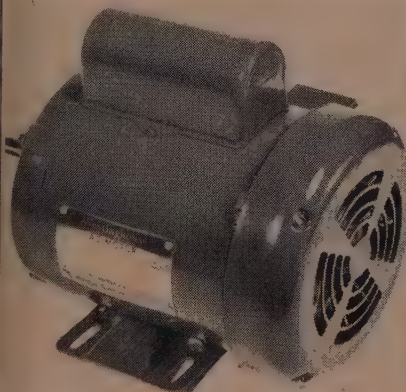


## Floodlights

(1)

Two new fluorescent floodlights, in FAF "Spacemaster" series for service stations, parking lots and outdoor work areas; and an FTC "Shieldbeam" fluorescent top-cutoff floodlight for airport loading aprons and other low-brightness applications. New weatherproof "Spacemaster" model is designed so that it can be mounted at one end, at its center, or with two units end to end. Models are available in 4-, 6- and 8-ft lengths. They can be equipped with either two or four lamps, and with any of three fittings. The FTC "Shieldbeam" fluorescent floodlight has a special top-cutoff feature so that no light goes above its horizontal level. It is available in 4-, 6- and 8-ft lengths. Lamps are 135° reflectorized, ultra-high output units with recessed double contact bases.

*Crouse-Hinds Co., Syracuse, N. Y.*



## Motor

(2)

A new line of totally enclosed fan-cooled motors on the NEMA 56 frame size is now available. Single-phase and polyphase motors rated from  $\frac{1}{3}$  to 1 hp at 1725 rpm are included in the new line. Features are permanently lubricated ball bearings, rigid foot mounting, large conduit box and a corrosion-resistant shaft extension. Automatic Thermoguard protection is also available as an optional fea-

ture on the single-phase capacitor start motors. Laminated slot insulation incorporating "Mylar" polyester film and thermosetting varnish makes windings resistant to heat, moisture, electric stresses and other hazards.

*Westinghouse Small Motor Div., Lima, Ohio*



## Voltage Controls

(3)

New Solidstat variable voltage controls use controlled rectifiers and solid-state devices, and will control inductive or lagging power factor loads. Operating on a closed loop, error-detector principle, they provide instantaneous response and are insensitive to line or load voltage changes. Standard types are available for 120- or 240-volt operation with output ratings of 6, 12 or 24 kva. Solidstats can be controlled by a potentiometer, by a current feedback sensing circuit or by a voltage sensing circuit.

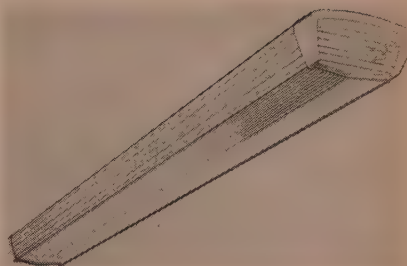
*Superior Electric Co., Bristol, Conn.*

## Controls

(4)

A line of compact, explosion-proof, surface mounted station boxes with heavy-duty controls has been announced. Unit measures  $4\frac{1}{8}$  in. deep,  $4\frac{1}{8}$  in. wide and up to  $18\frac{1}{8}$  in. long. Heavy-duty control operators include selector switches, pushbuttons, and pilot lights. Operators are assembled in cover when box is to be surface mounted. Same box also can be used for flush panel mounting by locating either standard or heavy-duty control operators through back of box. Boxes are produced in eight sizes for up to nine control stations.

*Adalet Manufacturing Co., 14300 Lorain Ave., Cleveland 11, Ohio*

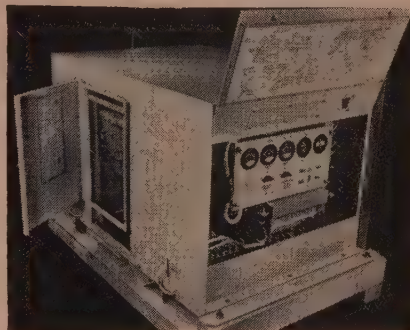


## Lighting Unit

(5)

A new corridor lighting unit, called the "Caron," has been introduced. The translucent white plastic diffuser has decorative longitudinal ribs that alternate with prismatic ribs. The plastic is supported the full length of fixtures and on both sides. There are retaining clips on each side. Plastic endcaps are attached to metal end plates. The Caron is available in 4- and 8-ft lengths, in both 1- and 2-light fixtures. Depth is 3 in.

*Curtis-Electro Lighting, Inc., 1536 South Paulina St., Chicago 8, Ill.*



## Motor-Generator Set

(6)

A new motor-generator set, mounted on skids, called the MD-4, is fully enclosed within its housing, but the whole unit is movable from place to place by dragging or lifting. Many different output voltage and frequency configurations are available. The set shown is used as a frequency converter, converting 60 cycle, 220/440-volt ac to 400 cycle, 208/120-volt ac, single or 3-phase. Desired output is selected by altering output connections of generator. Generator is rated at 50 kw or 62.5 kva with 0.8 power factor. Motor is a synchronous, 6-pole, 220/440-volt, 60-cycle, 3-phase input.

*Electric Products Co., 1725 Clarkstone Road, Cleveland 12, Ohio*





### Duct-Cable System (7)

A complete, preassembled underground circuit comes enclosed in plastic duct. The unit-type duct-cable system is engineered to overcome wasteful installation of short lengths of duct, joined by many couplings. Instead, single, long lengths of coilable plastic duct, already containing the required number of parallel conductors, are shipped on reels. Some applications for the system are underground street and highway lighting installations, underground distribution systems of various types, services to and between industrial and commercial buildings, connections to pad mount transformers, control cable installations, etc. Any number and type of conductor may be used, the only limitation being the I.D. of the duct, which is available from 1-in. to 2-in. sizes.

*Triangle Conduit & Cable Co., Inc., New Brunswick, N. J.*

### Time Meter (8)

A direct-current-running time meter, designated Series C-8, is now available. Unit provides digital readout of operating time from 1/10th of an hour to 9999.9 hours. The C-8 is powered by an automatically wound clock movement driving a five-digit digital readout counter and is available in all dc voltages and time counts. The standard model operates on 6, 12, 28 and 32 volts dc.

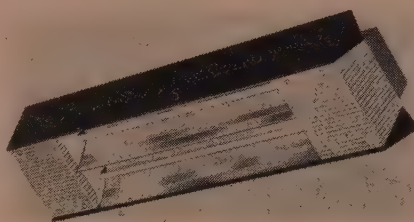
*Industrial Timer Corp., Highway 287, Parsippany, N. J.*

### Connector (9)

A new watertight connector for use in flexible liquid-tight conduit installations has been introduced. Called Chase liquid-tight connectors, fittings are used in the same way on flexible liquid-tight conduit as the standard Chase nipple is

used on rigid steel conduit. For flush type mounting in JIC and shallow panels. An "O" ring at knockout provides a positive seal against moisture. Connector has an insulated throat, beveled to stand off conductors running at right angles leaving connector. Connectors use standard pipe threads so that they can be joined with standard raceway fittings. Entire connector can be disassembled and reused. It is locked in place from outside of box. Connectors are available to cover conduit sizes from  $\frac{3}{8}$  in. to 4 in. Connectors are UL listed and CSA approved in sizes up to 1 $\frac{1}{4}$  in.

*Thomas & Betts Co., Elizabeth 1, N. J.*



### Heating Unit (10)

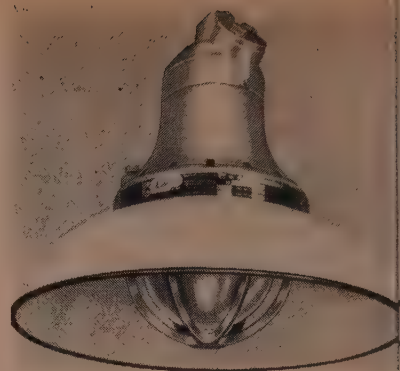
A new electric infrared comfort heating unit for high mounting heights, corridors or rooms with small floor areas, is now available. The "NB" heater confines most of the radiant energy to a narrower pattern, thus increasing available heat to people or objects directly below the unit. The use of one infrared source in the narrow beam distribution comfort heater will provide an asymmetric pattern. T-3 quartz lamps are utilized in the new heater with wattage from 1600 to 6000. Voltage is 208, 240 or 480.

*Fostoria Corp., 1200 N. Main St., Fostoria, Ohio*

### Bracket (11)

A new box and conduit support bracket has been introduced for mounting of boxes on metal studding. Bracket may also be mounted on wood studding or joists. The 16 ga galvanized steel mounting bracket securely mounts 1 $\frac{1}{2}$  in. deep outlet boxes flush with studding or joists. Two-in. deep switch boxes are mounted by inverting the bracket. Box and conduit brackets are available in two styles for mounting square and octagon boxes with  $\frac{1}{2}$  in.,  $\frac{3}{4}$  in. or combination  $\frac{1}{2}$  in. and  $\frac{3}{4}$  in. knockouts. Brackets are used with either rigid conduit or electrical metallic tubing.

*Steel City Electric Co., 1207 Columbus Ave., Pittsburgh 33, Pa.*



### Lighting Fixtures

Explosion-proof mercury vapor lighting fixtures, "H" series, Class I, groups C and D hazardous locations, are available. Fixtures come in a variety of styles, accommodating 175-, 250- or 400-watt lamps, with various types of reflectors. Clear, smooth globes are furnished as standard items on fixtures.

*Killark Electric Manufacturing Co., Vandeventer and Easton Ave. St. Louis 13, Mo.*

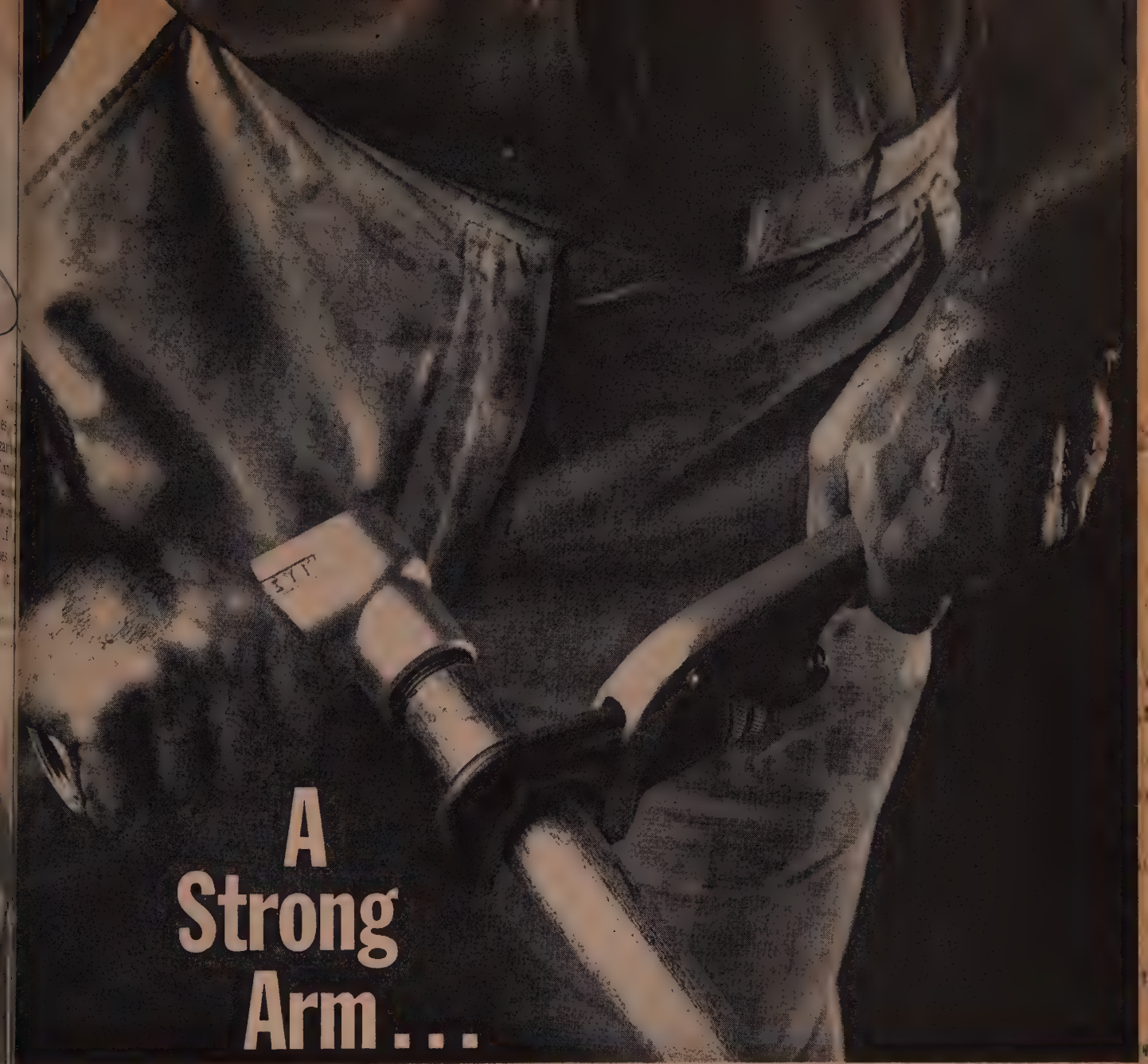


### Pipe Threader

A new pipe threading machine complete with built-in die-head, cutter, reamer and oil sump pump, has been announced. On sizes of pipe from  $\frac{1}{2}$  to 2 in. includes a tripping device automatically opens the dies when a correct tapered, full length, standard pipe thread has been cut. Two sets of dies handle the automatic opening range, one set for  $\frac{1}{2}$  and  $\frac{3}{4}$  in. and one set for 1 to 2 in. The drive motor of the Model 100-A is the universal, reversible, variable speed type, rated at  $\frac{1}{2}$  hp. Standard motor will operate from 115 volts, ac.

*Oster Manufacturing Co., Wadsworth, Ohio*

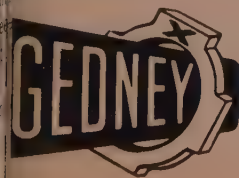
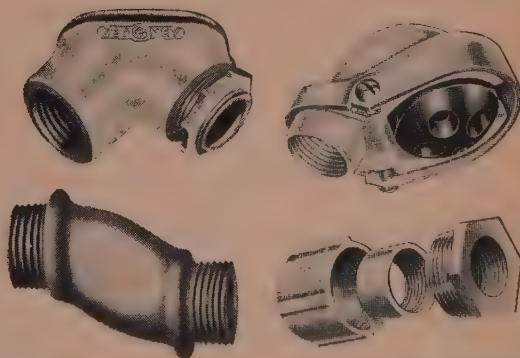




# A Strong Arm...

an fracture almost any fitting unless it's made of **malleable iron.**

rench it! Drop it! Pour on the pressure without restraint! A malleable iron fitting can take more punishment than any other fitting you can use. Why? Because malleable iron leads in every category of strength—tensile, impact, long term durability! No other material used for fittings today can do as well on the job as malleable iron. Experienced contractors and electricians know this. They know that “powder puff” fittings can't stand up under stress. They know too that Gedney has always been the leading name in malleable iron fittings. Protect your work and your reputation with Gedney. It costs no more!



**GEDNEY ELECTRIC COMPANY, INC.**

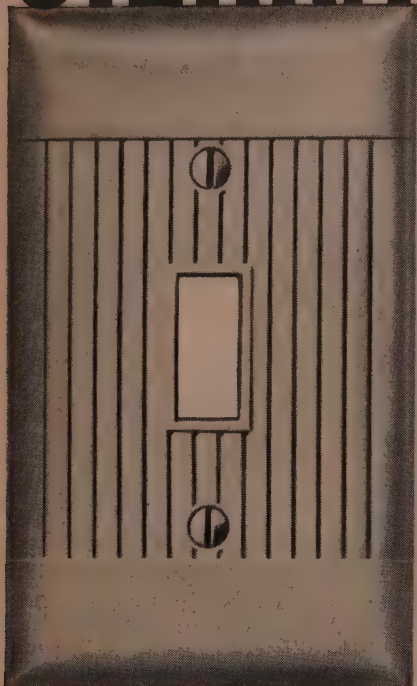
1270 Sixth Avenue, Radio City, New York 20, N. Y.  
Foundry, factory and shipping point: Terryville, Conn.

**“MALLEABLE IRON NEVER FAILS”**

Gedney malleable iron fittings can be supplied with a hot dip galvanized finish.



# SIERRA



## THE WORLD'S MOST COMPLETE LINE OF WALL PLATES

Your one source for the  
greatest variety of  
openings, styles,  
colors and materials.

Sierra Plastic Plates meet all  
codes and are listed by



### SIERRA ELECTRIC CORPORATION

15100 SOUTH FIGUEROA STREET  
BOX 85, GARDENA, CALIFORNIA

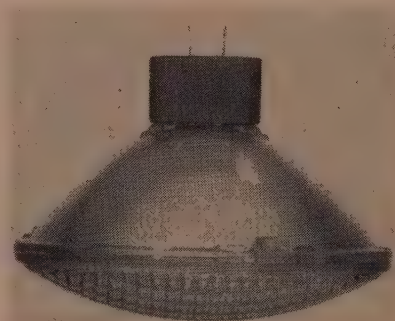
Write for more information and catalog



### Lighting (14)

A new concept in "picture" lighting for home and commercial installations has been achieved with introduction of an all-new bullet projector, designated Model H-2370. Unit has ability to cast rectangles, squares and geometric light forms through a built-in optical projector which is equipped with four frame-in shutters. Unit has a .040 spun aluminum enclosure, and an adjustable 360° swivel. Lamp is a 100-watt G16-½ bayonet base, dc. Catalog is available.

Halo Lighting, Inc., 4201 W. Grand Ave., Chicago 51, Ill.

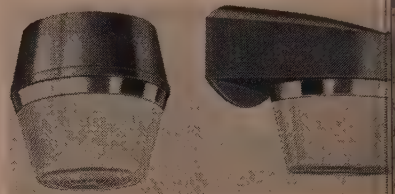


### Floodlamps (15)

New 300-watt spot and floodlamps, designated "Cool-Beam," have a special filter which reflects light but transmits heat. Two-thirds of the infrared energy is removed from the beam, making lamps suitable for floodlighting fresh meat, candy and show window displays. The lamps are hard-glass, sealed-beam bulbs, 7 in. in diameter, with built-in parabolic reflectors. Reflectors are composed of unique filters, consisting of 17 ultra-thin coatings of a metallic substance. Proper design of the filter produces a coating "tuned" to project a "cool" light beam and radiate heat out the rear of the lamp. The lamps are not interchangeable with existing types; their longer bases require fixtures especially designed to handle the increased amount of heat to which they will be sub-

jected. Lamps are available in three beam types: narrow spot, designated 300PAR56/2NSP; medium flood, designated 300PAR56/2MF; and wide flood, designated 300H56/2WFL.

General Electric Co., Large Light Dept., Nela Park, Cleveland, Ohio



### Lighting Units

New wall and surface-mount incandescent luminaires with wide spread Amcolenses are designed for outdoor commercial, industrial, and residential applications. Use of Amcol lens instead of white opal glass increases efficiency. Surface-mount unit is intended for mounting in overhang, under canopies, or walkways where a surface unit is more convenient than the comparison wall unit. The wall-mount luminaire is made of die-cast aluminum; surface-mounted unit is 18-gage aluminum. They are designed for 150- or 200-watt lamps. The wall-mounted design extends 9½ in. from wall, height is 8 in., width is 8½ in. Diameter of surface-mounted unit is 7½ in., overall height is 7½ in.

Art Metal Lighting Div., Wakefield Corp., 1814 East 40th St., Cleveland, Ohio.

### Motor Operator

A compact motor operator which features an exclusive side mount design for E, EH and F frame circuit breakers has been announced. Available for applications to 1500 amps, 600 volts, ac, the MOB, motor operator provides smooth, shock-free service by means of a cam arrangement to throw the operating arm, and use of a rugged gear helix motor drive. Control voltages for remote operation include 120, 240, 277, 480, 600 volts ac and 125 volts dc. Operator can be panelboard mounted with remote source control, or unit can be located remote from distribution center with clustered controls at the panel. Remote arrangements include push buttons, relays, automatic controls and combinations, using available voltages for the control circuits.

Lake Shore Electric Corp., 2 Willis St., Bedford, Ohio



mp (18)

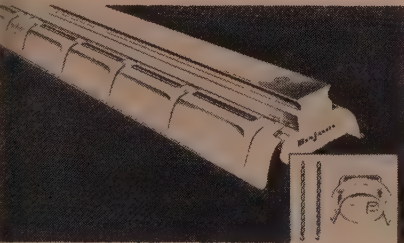
A 500-watt iodine quartz lamp, one-tenth the size but with twice the rated life of a comparable incandescent lamp, has been introduced. Dual fuses, housed in ceramic caps at each end of lamp, eliminate need for external fusing fixtures used in conjunction with lamp. Designed for general lighting installations, lamp is expected to find wide application in commercial and industrial establishments and in the recreation and transportation fields. Rated life of the new IQ lamp is 2000 hours. The 100-watt, fused IQ lamp is available in standard and rough service design.

Sylvania Electric Products Inc., Salem, Mass.

Receptacle (19)

A flush mounted night light and receptacle combination has been introduced. Rotary switch makes turning on and off simple. Modern, one piece, louvered, bakelite faceplate. Six-watt lamp furnishes enough light for safety and convenience. Dimensions of faceplate 1 1/2 by 2 1/4 in., mounting screws included. UL listed and CSA.

Rodale Mfg. Co., Inc., Emmaus, Pa.



Fluorescent Fixture (20)

A new line of fluorescent lighting fixtures featuring an "easy up" hanger system has been introduced. Known as the Task-Master series, the new line includes three models; a 400-watt rapid-start unit, 4 ft in length with 10% upward diffusion of light through slots in top of reflector; a 96-in. Slimline model with 10% upward diffusion and 96-in. Power Groove, SHO or VHO model with 25% upward component. All models feature two fluorescent lamps in parallel in the 4- or 8-ft lengths and 13 degree crosswise shielding. The ceiling outlet includes a plug-in receptacle.

Benjamin Div., Thomas Industries Inc., 207 E. Broadway, Louisville 2, Ky.



## CHANNEL PROBLEMS TO GAT®

### ELECTRICAL CONTRACTOR:

Einheit Electric  
Cleveland, Ohio.

### JOB SITE:

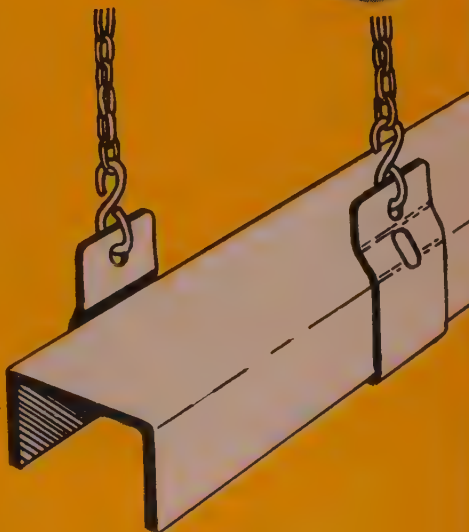
Cleveland Federal Savings & Loan.

### PROBLEM:

To install grid suspension system of 3/4" lather's channel in the inverted position below a concrete ceiling.

### SOLUTION:

GAT 2-B-L Channel Clips fastened to alternate sides of lather's channel and suspended from chain fastened to ceiling. This allows easy adjustment for leveling of fixture suspension system.



**GAT.** FASTENER Div.

ERICO PRODUCTS, INC.  
2070 EAST 81st PLACE • CLEVELAND 3, OHIO



# FROM PORTLAND TO PUERTO RICO ENGINEERS & CONTRACTORS PREFER SORGEL

From coast-to-coast more and more leading consulting engineers, plant engineers and contractors are specifying and insisting on Sorgel quiet-quality dry-type transformers. They recognize the true value of economy through quality features such as these:

- In Quiet-Quality units, performance data, such as core loss, copper loss, sound level, etc., is always equal to, or lower than, the guaranteed values submitted to the customer.
- Sorgel units are individually tested in accordance with NEMA standards. Certified tests are furnished upon request, to further substantiate the guaranteed data.
- All coils have end filler protection in each layer to prevent movement of conductors under heavy loads and short circuit stress conditions.
- The transformer core and coil unit is specifically designed for low sound level. In units 15 KVA and

larger, the core and coils are mounted on vibration dampening pads designed to suppress transmission of vibration to adjacent areas.

- All terminations are securely anchored, and solderless connectors are furnished on all transformers with terminal boards. Vacuum impregnated windings are brazed to the terminals.
- Connection covers are cushioned and easily moved by means of two captive bolts on smaller sizes, and four on larger sizes.

It's Sorgel advantages like these that protect your electrical distribution systems from failure, assure continuity of operation and maximum efficiency under all load conditions. You can always count on Sorgel units to perform as guaranteed. This carefully engineered economy through quality is the soundest reason of all for you to specify and insist on Sorgel dry-type transformers.



## SORGEL ELECTRIC COMPANY

Since 1916 the pioneer in the development, manufacturing and application of sound-rated dry-type transformers

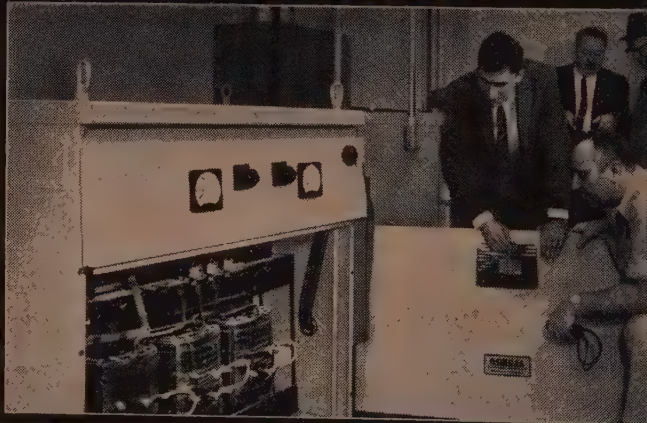
836 WEST NATIONAL AVENUE • MILWAUKEE 4, WIS.  
*Experienced sales engineers in principal cities*

### PORTLAND



Engineering group out west studies recently installed 112½ KVA Sorgel unit in Tektronix's main facilities at Beaverton, Oregon. Contractor commented on the fast installation of Sorgel units because of easy accessibility to terminal connections. Contractors claim Sorgel units are the easiest to install, best operating they have ever seen.

### CHICAGO



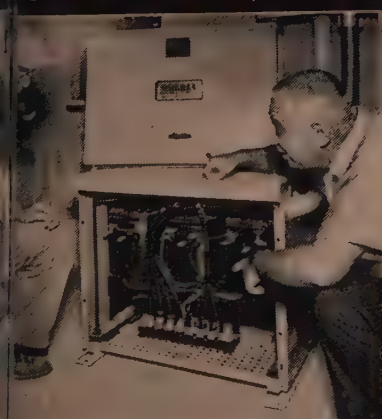
This team was responsible for the installation of these 112½ KVA units in Chicago's Morton Salt Building. They provide continuous electrical service for one of the nation's largest electronic computers. Sorgel built-in quiet-quality provides extra margin of safety.



QUIET  
QUALITY

the Symbol of Specialization

## LAUDERDALE

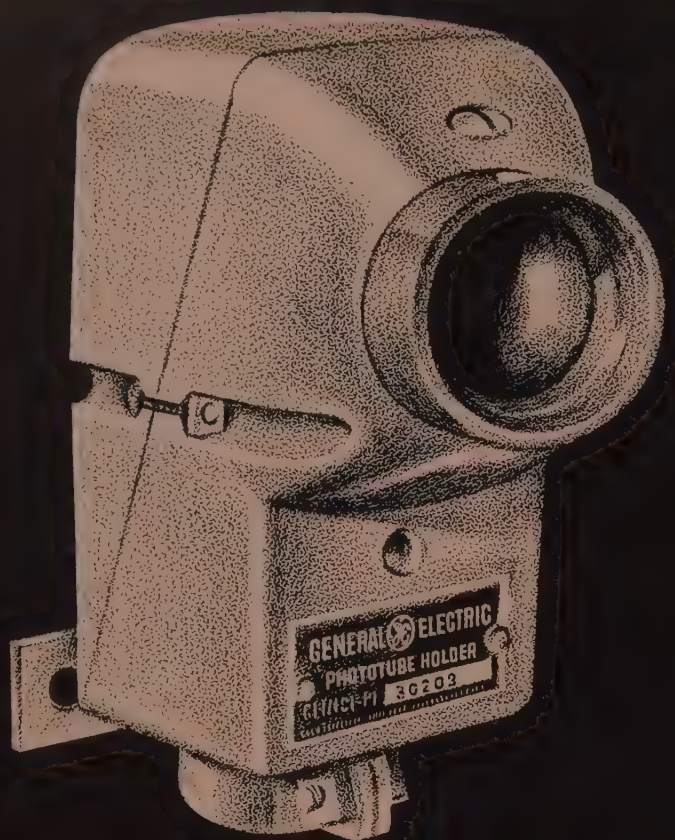


Quiet level of operation plus ease of installation are two of the many big advantages of this Sorgel 75 KVA unit recently installed in new Broward County Court House, Ft. Lauderdale, Fla.

## PUERTO RICO

Sorgel equipment serves internationally. This unit substation is installed in a psychiatric hospital in San Juan, Puerto Rico. It provides power for all electrical needs, lighting operating rooms, office electrical equipment, and utilities. Reviewing the installation are Mario Franceschini, Sorgel Engineering Representative, Ruben D. Reyes Electrical Engineer and Contractor, and maintenance man Modesto Aponte.





**Find a control job this can't do!**

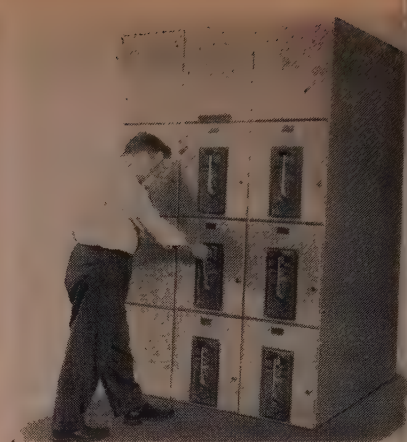
There aren't many. This dependable photoelectric unit and others in General Electric's full line can control an almost endless number of jobs. And they do it so efficiently that you'll save money by using photoelectric control.

A new 24-page catalog by General Electric, "Photoelectric Control," can help you learn more about these modern control devices—many brand new. The catalog shows how photoelectric systems work. It suggests applications: sorting, alarming, detecting, counting, sensing, protecting . . . and many others. Also, it has complete information—including prices—on General Electric photoelectric equipment and systems.

For your copy, write for bulletin GEA-6822, Section 793-8, General Electric Co., Schenectady, N.Y. After reading it, try to find a control job photoelectric units can't do for you.

*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**



## Switchgear

(21)

Introduction of a new line of 600-volt metal-enclosed low-voltage switchgear, Type ME, which incorporates numerous operating and maintenance benefits has been announced. It is available in continuous current ratings through 400 amps and interrupting ratings through 150,000 amps. The line features Pyro-Shield insulation, front access metering current transformers, power circuit breakers with self-contained dual or selective static overcurrent trip devices, and integrally mounted breaker lifting device. It is available with breaker mounted fuses on the 600- and 1600-amp frame size units designated as the LA-600F and the LA-1600F fused breakers to provide fault protection up to 200,000 amps with direct acting static overcurrent trip devices and trigger fuses which prevent single phasing.

*Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.*

## Recessed Luminaire

(22)

A new recessed incandescent downlight luminaire has been developed. A range of 19 different decorative ceiling trim and diffuser variations are available in various colors and finishes for use with the standard unit housing, including: louvered or open trims, decorative skirts or flat trims, aluminum or steel trims, dished opal or blown glass trims, fresnel lens, pinhole spots and conical shapes. Housing is adjustable to take any of seven lamp sizes in its built-in reflector-lampholder. Ceiling mounting plate suits unit to dry wall, plaster and even hung acoustical ceilings. Units are available prewired with JB on plate for ready connection to 60° wiring, or wired with 4½ ft of No. 14 AF leads or unwired.

*Litecraft Mfg. Corp., 100 Dayton Ave., Passaic, N. J.*



A new addition to the Stab-lok system of circuit protective devices for larger main protection in residential and commercial panels has been announced. Cat. No. NB100, 125, 2B150 and 2B200 bolted main breakers fit directly in main area of Stab-lok enclosures and do not utilize any branch circuit bussing space. Entire bussing is available for branch circuits. Available in ratings of 100, 125, 150 and 200 amps, the new 2-pole bolted main breakers are designed for rapid field installation on main bus studs by tightening two studs. Integral lugs on breakers are suitable for either copper or aluminum line conductors.

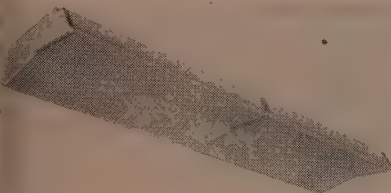
Federal Pacific Electric Co., 50 Morris St., Newark, N. J.

#### Control Center

(24)

A new control center, called IEKontrol Jr., has been developed. It is designed for wall mounting but can be floor mounted if desired. Designed to meet or exceed NEMA 2 and JIC requirements, the Model Jr. is designed for all makes of motor control. Bulletin CC-6.1 is available.

Machinery Electrification Inc., 66 Hudson St., Northboro, Mass.



#### Lighting Unit

(25)

A new fluorescent lighting unit for commercial and industrial applications has been announced. Known as the Wakefield Symmetric, the luminaire is designed for two, four or eight 40-watt, rapid-start fluorescent lamps. Available in 4- or 8-ft length fixtures, the 4-ft Symmetrics are available in either 2- or 4-lamp designs, while the 8-ft units are built for either four or eight lamps. The 8-ft units are basically two 4-ft units mounted in tandem. The plastic diffuser is 4 in. thick and is easily removable. Over-all body depth on the 2-lamp width unit is 3½ in. while depth for the 4-lamp width is 4½ in. It is designed for either close-ceiling or stem mounting.

Wakefield Lighting Div., Wakefield Corp., Vermillion, Ohio

# JOIN THE CIRCLE

OF CONTRACTORS  
WHO DEMAND  
ONLY THE BEST!

You can't argue with successful contractors any more than you can argue with success. When a contractor tells you Circle F is his one best single source for all residential, commercial and industrial wiring devices, you can bet your bottom dollar he's successful. And you can bet he's paying bottom dollar, too. Join the circle of success, insist on Circle F.



## CIRCLE F 277 VOLT

### GROUNDING DEVICES

New, 15 amp. 3-wire "U" Ground devices have been designed for lighting applications and other equipment requiring 277 volt circuits. They meet all applicable Government, NEMA & ASA specifications and are UL listed.



Where interlocking and positive grounding are essential to eliminate accidental disconnects, Circle F's "Circlok" Grounding devices are ideal.

**CIRCLE F MFG. CO. TRENTON, N.J.**



# "Hi-RED"

PLASTIC EXPANDING  
SCREW ANCHORS



HOLD ...  
HOLD ...  
**HOLD**  
WHERE  
OTHERS  
FAIL!

**SAVE UP TO 70%**

USE IN ANY MATERIAL YOU CAN  
DRILL: CONCRETE, STONE, CIN-  
DER BLOCK, BRICK, MORTAR,  
TILE, ETC.

## MILLIONS IN USE!

(A REAL JOB-PROVEN ANCHOR)



"Hi-RED" anchors  
may be cut as need-  
ed for short screws



... and used in  
tandem with long  
screws.

- Anchor costs less.
- Costs less to install  
—takes smaller hole  
... no tamping.
- Terrific holding power  
(P.T.L. ratings up  
to 4,180 lbs.)
- Sizes up to 1/2" lag  
screw.

BUY 'EM IN BULK  
OR KITS!

## FREE SAMPLES

SEND "Hi-RED" SAMPLES

NAME \_\_\_\_\_  
FIRM \_\_\_\_\_  
STREET \_\_\_\_\_  
CITY \_\_\_\_\_ STATE \_\_\_\_\_



**HOLUB INDUSTRIES, Inc.**

442 ELM ST. • SYCAMORE, ILL.



### Lighting

(26)

A new wall bracket, called "Delta 7," is for lighting outdoor and indoor areas to insure safety and protection of industrial, institutional and commercial buildings. Up to 200 watts providing widespread light distribution will illuminate entrances, walkways, driveways, loading platforms, airplane aprons, railroad stations, parking areas and other locations in and adjacent to buildings. Installation to cast aluminum junction box is by means of patented center lock-up. "Folio 62-3" is available.

McPhilben Mfg. Co., Inc., 1329  
Willoughby Ave., Brooklyn 37, N. Y.

### Boxes

(27)

A new line of 4-in. square outlet and device boxes with metal tabs to accommodate 3/4-in. and 1-in. plasterboard in 2-in. solid partition wall construction has been introduced. Boxes are an addition to existing line for 3/4-in. and 1-in. plasterboard. Light gage metal tabs are welded to two sides of boxes. Metal tab prongs are bent outward at 90° angles from box to embrace various thicknesses of plasterboard. The line consists of Cat. No. 52141-ED-1/2 regular type box and Cat. 1-1 1/2-ED-1/2 thru-wall box. Boxes are 1-in. deep with standard 1/2-in. knockout arrangement.

Steel City Electric Co., 1207  
Columbus Ave., Pittsburgh 33, Pa.

### Intercom System

(28)

A new, transistorized, multi-station intercom system for interoffice communication has been introduced. Bogen TIX intercom series features an "Auto Respond" switch which makes it possible for a called station to reply without operating a station selector or talk-listen switch or knowing the calling station's location. TIX is a low-voltage intercom system which operates on one single 117-volt ac power supply. It also includes a "Record-A-Call" feature which automatically notifies a master that another master

Installation Economy with Time-Save

## "SIZE-MARKED" MINERALLAC

"Minny-Twist"  
and  
TRADE MARK

## Standard Bolt Type Conduit Hanger



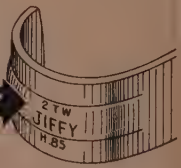
MINERALLAC "MINNY-TWIST" CONDUIT HANGER  
"Minny-Twist" is this years new addition to the ever-growing line of Minerallac Cable and Conduit Supports. Installs in 3 easy steps: (1.) Install hanger with screw or bolt.—(2.) Simply hang conduit in hanger.—(3.) Insert tongue in slot and twist tongue one-quarter turn with "Minny-Twist" closing wrench. No illustration above.

MINERALLAC STANDARD CONDUIT HANGER  
This is the original Minerallac Conduit Hanger... tried, tested and proven for over one quarter of a century in millions of electrical installations. Minerallac Standard Conduit Hangers are available in a complete range of sizes from 1/2" Thin-Wall to 4" Rigid.

### Exclusive Feature!

- Each Minerallac fitting is "SIZE-MARKED". All are clearly and individually stamped with its exact size for immediate identification and quick and easy handling.
- Ends time-consuming guess-work and costly mismatches in the stock room and on the job.

WHEN IT'S  
"SIZE-MARKED"  
YOU CAN  
BE SURE!



Order from Your Electrical Wholesaler  
LITERATURE OR SAMPLE ON REQUEST

**MINERALLAC Electric COMPANY**  
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25 N. PEORIA STREET • CHICAGO 7, ILLINOIS

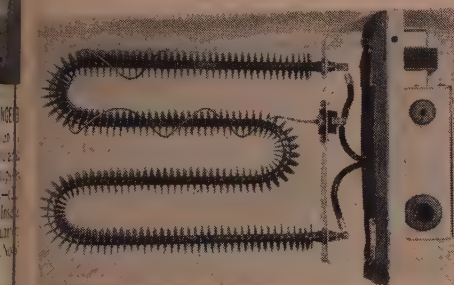


ishes to converse. TIX is available in two models, the TIX-11 master station for operation with up to ten other stations and TIX-24 master for operation with up to 23 other masters or remotes. Two types of remote stations are available. RIX-1 can initiate a call to one master station. RIX-6 can initiate a call selectively to any one of six masters. *Bogen-Presto Division of The Siegler Corp., Paramus, N. J.*

## Generator Units (29)

New "no-break" generator units are available for industry. Unit provides 100% continuous power to critical loads when commercial power fails. Unit is comprised of a Nordberg power chief engine, coupled to a statically excited motor generator through a heavy duty magnetic clutch. In the event of a power failure or a drop in voltage, the motor is automatically disconnected from the line, energizing the magnetic clutch which connects the flywheel to the engine crankshaft. Sets are available in 5 kw to 25 kw capacities.

*Automatic Power, Inc., 205 Hutcheson, Houston 3, Texas*



## Duct Heater (30)

A new supplementary duct heater which provides additional heat generation for heat pump units by direct attachment to ductwork has been announced. It goes into new or existing ductwork without any dismantling of ductwork. Fail-safe type safety thermostat prevents overheating and eliminates any danger of fire. Heater's master package consists of a 5-kw heater element mounted on its bracket, complete with externally mounted low-voltage transformer, control relay, contactor, safety thermostat and terminal board all assembled in an electrical enclosure for field installation. Heater may be installed on any duct measuring 16 by 12 in. or larger.

*Typhoon Heat Pump Div., Hupp Corp., Tampa, Fla.*

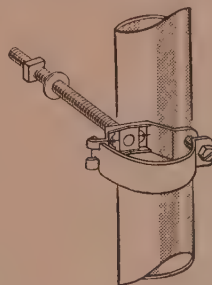
RIG  
TIME  
IS  
JIG  
TIME

PP

MAST  
KITS



You'll like the "jig time" installation of a Porcelain Products mast kit. Each element in every kit, from the clamp-on entrance cap to the slip-fit offset reducer, speeds the job of putting up a service mast. The new boltless flash-plate in the 2075 kit as illustrated above supports the mast at roof-line and eliminates blocking between the rafters.



PP

AND NOW... the newest timesaver... in the 2085 kit is a split-clamp hanger with sideways adjustment. The "Adjusto-clamp" permits you to straighten mast after installation, or align mast with meter socket. It's the only adjustable clamp on the market. Included as standard items in all 2085 kits and available separately for 2" or 2½" pipe. Specify Cat. No. 7542 for 2", 7543 for 2½" pipe.

**PORCELAIN PRODUCTS CO.**  
225 N. PATTERSON ST. CAREY, OHIO

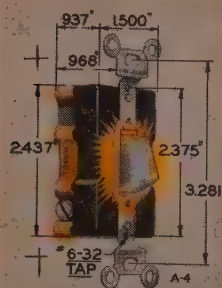




when light is needed quickly . . .  
install a.c. "PRESSWITCH" with lighted button.

A tiny, subminiature, neon bulb in the button glows when the switch is off. Units are available in 15 and 20 ampere, 120 volt ratings in single pole, 3-way and 4-way types . . . also in 277 volt on special order.

As a pilot light, "Presswitch" is supplied in 15 and 20 ampere, 120 volt ratings, single pole only. Here, red button glows whenever switch is on.



No special wiring involved—costs pennies a year to operate. Write for complete A. C. Switch brochure.

A. C.  
**pressSwitch®**

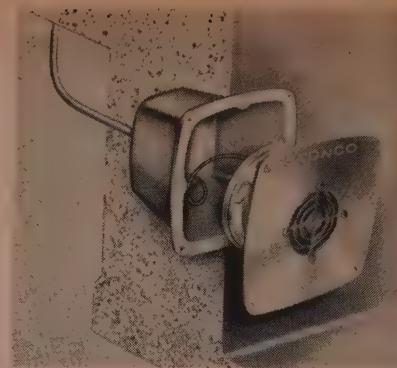
WITH LIGHTED BUTTON

Cat. No. 1257-I 15 amperes, 120 volts A. C.  
single pole with feed-thru terminal



**HARVEY HUBBELL**  
INCORPORATED  
Bridgeport 2 Connecticut

"Presswitch" is a trade mark of Harvey Hubbell, Inc.



### Loudspeaker System (31)

A new underwater loudspeaker system permits swimming classes, water ballet troupes, and others engaged in synchronizing swimming or water sports, to hear instruction or music while practicing or performing. Other uses include in water "mood music" for resorts, hotels, motels, cabana and country clubs, or residential installations. The fully-submersible speaker system is part of a complete UL-listed line of equipment designed specifically for underwater use.

Stonco Electric Products Co., 333 Monroe Ave., Kenilworth, N. J.

### Trencher (32)

A new type lawn trencher, specifically made for installation of gas and electric lawn lights and lawn sprinkler systems, has been introduced. It weighs 180 lbs and will cut a trench 1½ in. to 3 in. wide and up to 24 in. in depth.

Modern Products, Inc., Exeter, Neb.

### Power Plant (33)

New 110-volt, 60-cycle, ac, continuous-duty portable power plant handles lighting loads up to 1000 watts, powers hand tools with up to 10-amp rating. It is recommended for construction sites, trailers, campers, homes, standby or emergency needs. Rotary field generator has glass-insulated windings and transistor excitation. Two, 2-wire receptacles with ground are provided.

Dayton Electric Mfg. Co., 126 South Oakley Blvd., Chicago 12, Ill.

### Substations (34)

A new line of secondary unit substations has been introduced. Using the CPR (Customer Preferred Rating) trademark, the line offers combinations of standard



meet about 85% of requirements in the 500-1500 kva range. CPR substations provide a completely electrically and mechanically coordinated assembly, from incoming line section to outgoing terminals, designed for easy installation. The CPR line offers substations for incoming voltages of 4.16, 12.0, 13.2 or 13.8 kv. Ventilated dry-type transformers rated at 500, 750, 1000 or 1500 kva without fan, or 750/1000, 1000/1333 or 1500/2000 kva with fan, may be obtained. Secondaries may be 480 delta or 480Y at all ratings and 208Y at ratings up to 1000 kva. Feeder breakers come in frames of three 1600-amp units or four 600-amp breakers.

*I-T-E Circuit Breaker Co., Philadelphia, Pa.*

## Connectors

(35)

A new series of large size liquid tight connectors has been added to this line. Fittings which formerly ranged from  $\frac{3}{8}$  in. through 2 in., straight connectors are now available in 2 $\frac{1}{2}$ -, 3- and 4-in. sizes. They seal out all synthetic coolants, detergents, oil and other types of liquids used in industry. Fittings will not pull out under severe types of stress and are completely reusable.

*Electrical Fittings Corp., 123 Smith St., E. Farmingdale, N. Y.*

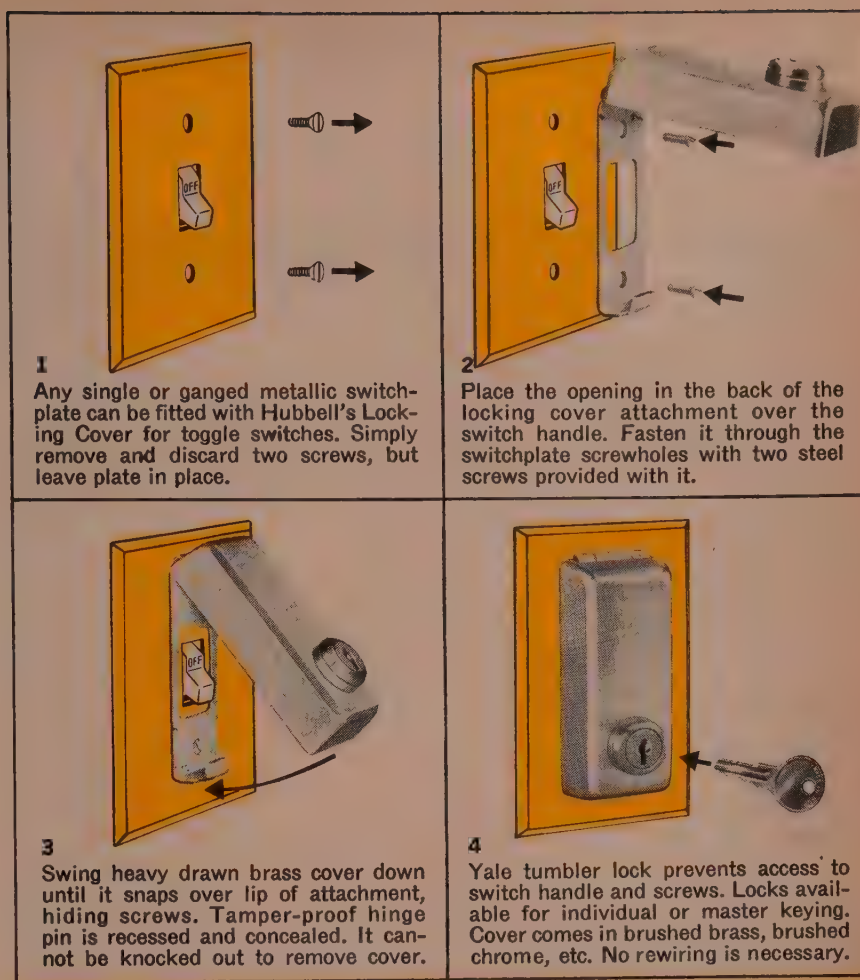


## Electric Generator

(36)

A new electric generator that can be carried in a truck or car for instant use anywhere is available. 2250 watts of 110-volt ac provides a surplus of power for lights, electrical equipment and power tools. This 94-lb generator Mark II, is designed to be carried to the job. It has permanent ceramic magnets. A starter kit is available when using this unit as a standby source during a power failure.

*Hearth Industries, 209 Brooklyn Ave., Wellsville, N. Y.*



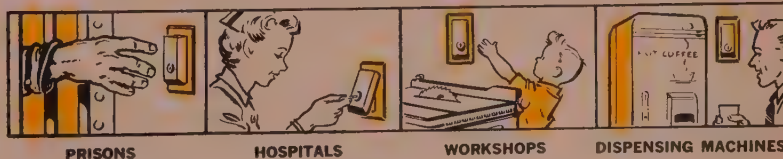
# Locking Covers for Switches Sell Big to Institutions

Wherever there's a reason for preventing the unauthorized operation of switches, there's a reason for Hubbell's easy-to-install Locking Cover Attachment.

Equipped with a Yale lock, this rugged device is being bought in quantity by hospitals, corrective institutions, schools, and business organizations... despite the fact that it has never been advertised. A brief newspaper

article about it flooded us with over 1,000 inquiries from architects, product designers, builders, institutions, and safety officials.

There's nothing else like the Hubbell® Locking Cover on the market, and it comes as near to selling itself as any product we've ever developed. If you are a Hubbell distributor and are not pushing it now, Catalog Page 127-K can be your key to easy sales.



HARVEY  
**HUBBELL**  
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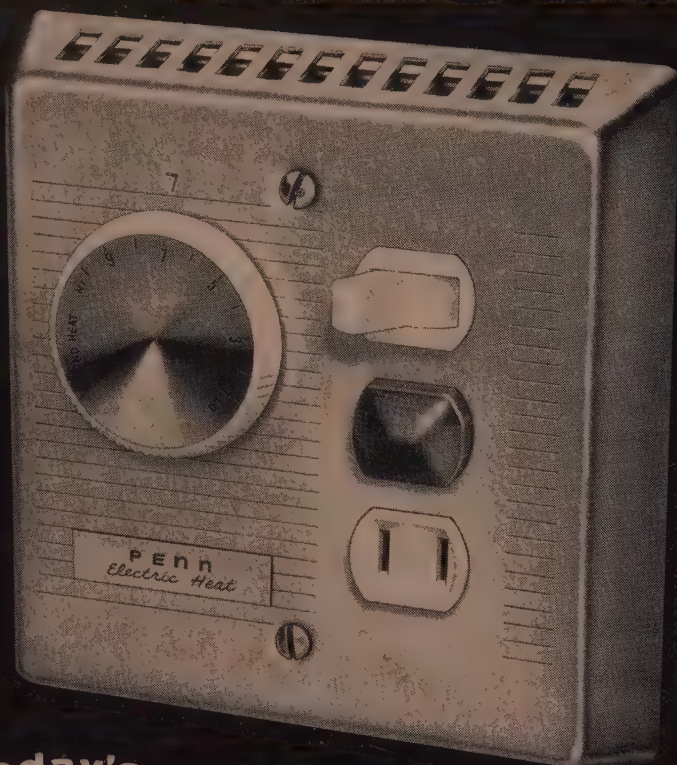
Bridgeport 2

Connecticut



introducing...

# SWITCHSTAT



today's most versatile

## ELECTRIC HEAT THERMOSTAT

**combines temperature control with interchangeable wiring devices!**

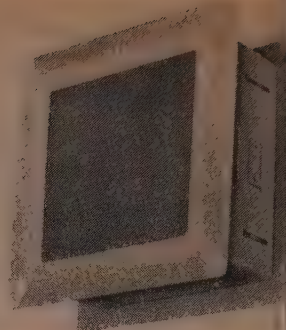
For bathrooms, kitchens, recreation rooms, and any place you need a room thermostat *combined in one mounting* with interchangeable switches or other devices . . . use the all-new Penn *Switchstat*.

Simple to install and easy to wire, *Switchstat* is beautifully designed to harmonize with any room decor. It offers more convenience than any other electric heat thermostat. You can easily install one, two or three wall switches . . . pilot light . . . convenience outlet . . . or any other combination of interchangeable wiring devices all in one attractive unit. Try it on your next job, you'll discover *Switchstat's* many advantages. Ask your wholesaler or write to Penn.

**PENN CONTROLS, INC.** Goshen, Indiana

EXPORT DIVISION: 27 E. 38th ST., NEW YORK, N.Y.

AUTOMATIC CONTROLS FOR HEATING, REFRIGERATION, AIR CONDITIONING, APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES



### Lighting Fixtures

(3)

The "Wall-Thru" fixture is designed for lighting adjacent rooms simultaneously, through walls and partitions. Unit is ideal for motels, hotels, offices, commercial buildings and institutions. In residences, fixture may be used to provide combined hallway and closet lighting or kitchen and dining area lighting. Finishes include chrome, brass, copper, aluminum and painted eggshell. Dimensions of fixture housing are 7½ in. by 7½ in. by 4 in. A variation of the "Wall-Thru" is the "Aisle-Lite," a recessed unit engineered for any low intensity step, aisle, or night-light installation. It is available in same finishes, and over-all size is 7½ in. by 4½ in. by 3½ in.

Markstone Mfg. Co., 1531 N. Kingsbury St., Chicago 22, Ill.

### Personnel Boom

(38)

New model PBHE personnel boom is equipped with its own 9 hp air cooled engine and fully hydraulic drive with electric solenoid control. A combination starter generator and battery are separate from the truck electrical system. Booms are available in platform to-ground heights of 24, 28, 32 and 36 ft. Booms are elevated by a hydraulic cylinder from 16° below horizontal to 70° above horizontal. They rotate 360° continuously.

Utility Body Co., 1530 Wood St. Oakland 7, Calif.

### Voltage Regulator

(39)

A new ac line voltage regulator has been introduced which provides stepless voltage control for power loads up to 60 kva, single phase, and 180 kva, 3-phase. It is designed for industrial application. Regulator is basically a tapped transformer with an automatic switching arrangement to adjust the tap voltage. Load voltage is held constant by a monitoring system that senses small changes in the output



ltage. Regulator is available in models, two are portable, with power outputs from 500 va to 60 a (single phase, standard 120, 0 or 480 volts). Three single phase units can be connected 3 phase. Bulletin 22B01 is available. Acme Electric Corp., Cuba, N. Y.

#### Lighted Ceiling System (40)

A new lighted ceiling system, known as Infiniflex, has been introduced. It uses a new Torsion-Ease hinge device which permits each panel to swing down for cleaning or relamping. Also uses noncombustible metals and self-extinguishing plastics. While supported by a bar grid, panels, having concealed joints, attach to bottom of bar, totally obscuring grid from all angles of view.

*Integrated Ceilings & Grilleworks, Inc., 11766 West Pico Blvd., Los Angeles 64, Calif.*

#### Static Inverter (41)

A new static inverter for operating standard fluorescent lamps from a 48-volt dc battery source has been developed. The inverter replaces present battery operated incandescent emergency lighting systems by using new or existing fluorescent lamps, ballasts and fixtures. Inverter produces 115 volts, single phase 60 cycle, ac power for operating 1500 watts of standard 60 cycle lamps and their ballasts. The inverter's size, 31 in. by 31 in. by 9½ in., and natural convection cooling will allow it to be wall installed or surface mounted. Hermetically sealed silicon controlled rectifiers are contained in the inverter section.

*General Electric Co., Schenectady 5, N. Y.*

#### Intercom System (42)

A dial-type loud speaking intercommunication system has been introduced. Called the LS Series Telecom, the system features compact dial-selection speaker-receiver units, a fully automatic private switchboard, and simple wiring. Unit permits four simultaneous conversations and 23 lines. Each line accommodates one master intercom station. Any number of extensions can be installed with each master station. Size is 7 in. wide by 6½ in. high and 7 in. deep.

*Webster Electric Co., Racine, Wis.*

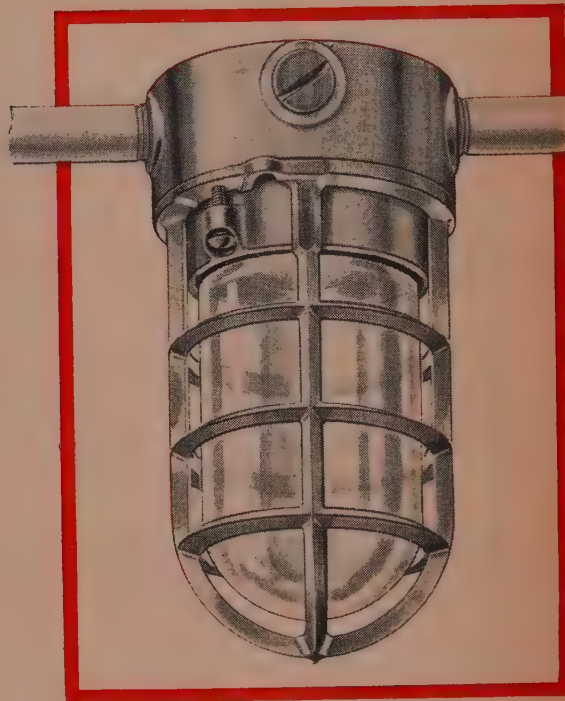
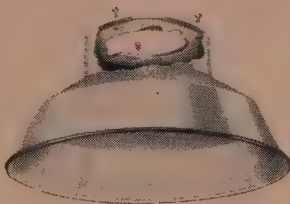
Quickly installed...a snap to service!

# VAPOR\* TIGHT

100 WATT  
FIXTURE



Combination  
junction box  
has 4 holes and  
3 plugs as standard.



\*UL-listed-fixtures enclosed and gasketed.

Adalet VT fixtures give you the ruggedness and corrosion resistance of cast aluminum construction.

**Installation** — is easier with Adalet multiple tapped 4-way hub boxes.

**Service** — is a snap with the no-thread "twist-lift" bayonet-lock guard.

**Globes** — A choice of 7 colors in standard glass; 3 in heat resisting. Available for wall, pendant and outlet box mounting; 100 to 500 watt sizes.

# Adalet

MANUFACTURING COMPANY  
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Vapor-Tight  
Bulletin  
E 360





# Does emotional advertising influence you?

In advertising some consumer products — where there's little difference between one brand and another — emotional appeals may be most effective. But when it comes to industrial fire alarm systems, the differences are so great that facts are more convincing. Take these for example.

**Fact No. 1** — Municipalities carefully investigate the various types of fire alarm systems before they make a choice. They want assurance that the system will be efficient, reliable and economical.

**Fact No. 2** — The overwhelming majority of communities that have fire alarm systems have chosen Gamewell. Take a look the next time you pass one of those familiar red boxes on the street. Chances are you'll see the name Gamewell.

Doesn't it seem logical that the reasons Gamewell fire alarm systems have been selected by an overwhelming majority of municipalities hold true for industrial systems, too? Gamewell Flexalarm Systems for industry are the products of our more than 100 years of experience in providing fire protection. They offer completely automatic fire detection and alarm sounding, plus interconnection with other services — such as sprinklers.

Get all the facts about Flexalarm Systems. Write The Gamewell Company, Dept. 1408, Newton Upper Falls 64, Mass. A Subsidiary of E. W. Bliss Company.



BLISS

**Gamewell®**

FIRST...WHEN SECONDS COUNT



**Fluorescent Fixture (43)**

A new surface-mounted commercial fluorescent fixture has been introduced. The "Slenderline," 3½-in. deep, has sculptured illuminated metal sides to blend it into the ceiling. It is furnished in two widths, 15½ in. or 25½ in. and in 2-, 4- or 6-lamp rapid start. A hinged diffuser frame swings down from either side or may be completely removed for relamping. Brochure is available.

*Solar Light Manufacturing Co., 1990 N. Mannheim Rd., Melrose Park, Ill.*

**Air Curtain Fan (44)**

The B15RF refrigeration door air curtain fan provides an invisible, thin wall of high velocity air that prevents the escape of cool air and entry of warm air. Fan fits any door opening with a simple, surface operation, requiring no structural changes. Air volume and direction can be adjusted with external controls. Fan is available with direct-connected 115 volts, one-phase or 220/440 volts, 3-phase motor. It can be manually controlled to operate when refrigerator room door is open or automatically controlled by use of a standard jam-type switch installed in door frame. One unit protects door openings up to 5-ft widths. For wider doors, two or more units may be used. Bulletin DB1-205 is available.

*Ilg Electric Ventilating Co., 2850 N. Pulaski Road, Chicago 41, Ill.*

**Circuit Breakers (45)**

Fusematic molded-case circuit breakers designed to afford safety and protection in systems where fault current may reach 100,000 symmetrical rms amperes. Available in ratings of 15 to 600 amps, 2- or 3-pole at 600 volts ac or 250 volts dc, the breakers feature a common-trip bar located adjacent to current limiters which ensures all breaker poles are automatically tripped if any of limiters function, if limiter housing is removed, or if an individual fuse is omitted from

housing. Fusematic circuit breakers combine and coordinate all advantages of Type AB molded case breakers and Econolim current limiting fuses to provide three-phase protection for systems.

*Federal Pacific Electric Co., Paris St., Newark, N. J.*

**Switches**

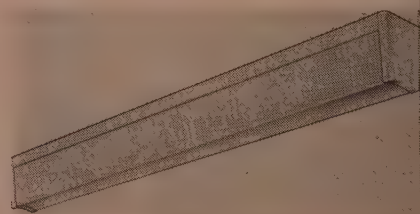
A twin 3-way wall switch for single outlet box has been introduced. Feathertouch twin wall switch can be installed in a single gang outlet box and operates in normal vertical position. It is available with either two-way action circuitry or two single-pole switch and is installed together with standard size 4½-in. by 2½-in. wall plate. For operation at 120 volt the switch is rated at 15 amps.

*H. J. Theiler Corp., Whitinsville, Mass.*

**Intercom System**

Wireless and fully transistorized the new Model FW-40 2-station system plugs into ac outlets. Cabinets are formed of high impact styrene compound. It is offered in systems of 2, 6 and 12 stations. The 2-station model may be expanded by adding additional single station units to the system so long as they may all be plugged into ac lines.

*Fanon Electronic Industries Inc., 439 Frelinghuysen Ave., Newark 14, N. J.*



**Corridor Fixtures**

New D-Series corridor fixtures use prismatic principle for corridor lighting. In both the 1- and 2-light D-Series fixtures light is distributed evenly and adequately on both vertical and horizontal planes. End pieces and center supports of the Series are die-cast and the prismatic, clear polystyrene lens is firmly attached. D-Series comes in 4- and 8-ft lengths. The 1-light is 4½ in. deep, the 2-light is 6½ in. deep. Both occupy 4½ in. on the ceiling.

*Curtis-Electro Lighting, Inc., 1536 S. Paulina St., Chicago 8, Ill.*





## Exit Lights (49)

A complete line of compact lighted exit units, known as Pathfinder, has been introduced. The unit combines unique circuitry with a solid-state electronic device to deliver guaranteed burning life of 10,000 hours for the four lamps illuminating each sign. Signs employ 7-watt filament lamps which are operated at reduced voltage. Pathfinder units are available for six different mountings with a choice of red or green letters or background. All basic signs, except recessed, measure 13 in. by 9 in. overall with a thickness of less than 1 in. at top tapering to just over 1 in. at bottom. Literature is available.

*The Miller Co., Meriden, Conn.*

## Transformers (50)

New single- and 3-phase dry-type transformers, Types EP, EPT, DT-3 and DS-3, from 3 to 500 kva are available. They are for indoor installations such as institutions, commercial buildings and industrial plants where concentrations of people are present. Type EP transformers can be installed anywhere, in any position—on floor, wall or ceiling. Types DS-3 and DT-3 are for floor, platform or ceiling mounting. Application of silicones and sealed insulation systems prevents arc-over and tracking caused by excessive dust and humidity.

*Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.*

## Intercoms (51)

A new series of transistorized intercoms for office, factory or home use has been introduced. "Series T" intercoms, are designed for unrestricted communication between master station, between single master and multiple remote stations or between masters and remotes intermixed in any combination. The TIA-6 is a 6-station master with volume control, press-

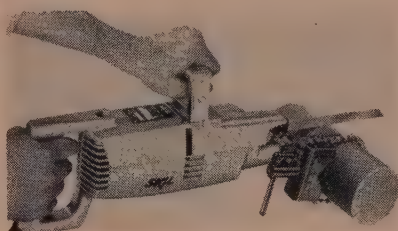
to-talk bar and 7-position selector, including an "all-call" position to signal all remotes and a "mute" position to attenuate background noise from remotes. Similar features are found on the TIA-12 master station designed for operation with 11 other stations.

*Bogen Communications Div., Lear Siegler, Inc., Paramus, N. J.*

## Cable Trimmer (52)

A newly developed power transmission cable trimmer which will accommodate 85 sizes of ACSR cable has been announced. Designated the RIDGID No. 87 ACSR cable trimmer, tool is designed for removal of aluminum strands of cable prior to splicing operations. Capacity of tool is from 8 to 1,780,000 circular mils. Twelve stock bushings are available within the 336,400 through 954,000 mils range. Other sizes within the over-all range of 8 through 1,780,000 mils range can be supplied on request. Bushing holder, which consists of two hinged halves that are tightened onto the cable using a wing nut, prevents unravelling of outer strands.

*The Ridge Tool Co., 400 Clark St., Elyria, Ohio*



## Electric Saw (53)

A new portable electric hack saw with a built-in vise has been announced. It combines a reciprocating-type saw with a wrap-around, chain-tightening vise which can be adjusted to hold bar stock, pipe and other materials from 3/8-in. to 5-in. dia. It is known as Model 702 Recipro saw and can operate at two speeds—1,000 or 1,400 strokes per minute. Blade is mounted off-center for cutting close to walls and corners, and is reversible for cutting upwards as well as down. An auxiliary handle on top adjusts to three different positions for either left- or right-handed operation or it may be removed entirely for working in confined areas.

*Skil Corp., 5033 Elston Ave., Chicago 30, Ill.*

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## REGARDLESS

... if your job calls for off-the-floor work  
... there's a Baker Scaffold to fit your need.

Baker now offers three types of transportable scaffolds to keep pace with the job.

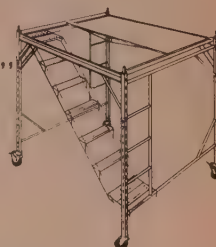


### BAKER SCAFFOLD

—the original, transportable scaffold for quick, easy maintenance at nominal heights.

### BAKER MODEL "K" SCAFFOLD

—for larger work platform area.



### BAKER TELE-SCAF

(formerly Atlas Hi-Lift)—a telescoping scaffold for those special jobs that require frequent attention or special equipment.

Baker Scaffolds are designed for getting off-the-floor work done faster—pay their way many times in labor time saved.

Also, there are many accessories for Baker Scaffolds to make your particular job even easier. Why not get full facts now.



Write today for complete data on the Baker Scaffolds.

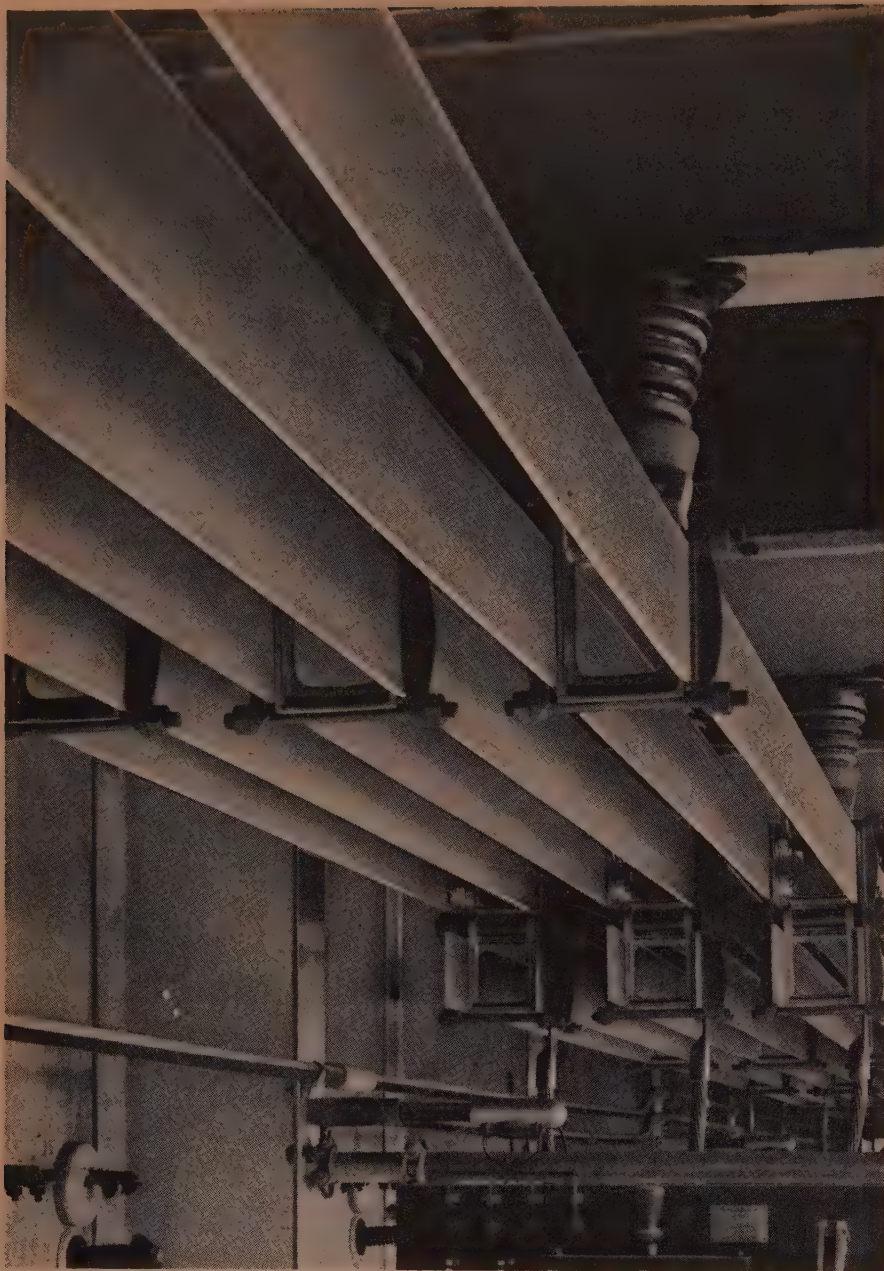
# **BAKER SCAFFOLDS**

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## This bus costs half as much as copper

It's aluminum, of course. It weighs less than half as much as copper (for equivalent capacity). It's easy to bend, form, drill, cut, punch and weld. And bolted joints of aluminum to aluminum or aluminum to copper are easily made with standard procedures. □ It's corrosion resistant, too... even in highly contaminated atmospheres such as exist in or near chemical and other industrial plants and in sea coast locations. □ Before you expand or modernize your capacity, get all the facts about Alcoa aluminum bus conductor. We supply it in a wide variety of shapes and sizes for all applications. Just call or write your Rome-Alcoa representative or Rome Cable Division of Alcoa, Dept. 7-92, Rome, New York.



### Instrument

New "goose-neck" version of Photo-Tachometer gets around and over obstacles, to measure speeds of inaccessible moving parts, in dangerous and sometimes out-of-sight locations. This "Snorkel" tachometer permits one to be as far as 10 ft away with direct reading indicating unit when making a measurement. The range is 0 to 12,000 rpm. Base of the Snorkel extension has an Alnico magnet for attachment to any ferrous metal surface. Flexible shaft allows positive and fixed aim of photocell and light beam. Instrument operates on its own transistorized power-pack. It is operated by pressing button above the scale and reading speed directly in rpm. Bulletin is available.

James G. Biddle Co., 1316 Arch St., Philadelphia 7, Pa.

### Circuit Breakers

In response to increased use of larger 3-phase air conditioners in homes and other occupancies, FPE has developed 240-volt 50- and 75-amp 3-pole Type NA delta circuit breakers which fit into single-phase Stab-lok panels and provide protection for these circuits. Cat. No. L3P50 and L3P70 are designed to stab into two panel busses and receive line connection of third phase at solderless terminal on gutter side of device. Units are suitable for 3-phase LV systems and are furnished with a hasp to permit locking of circuit in "off" position.

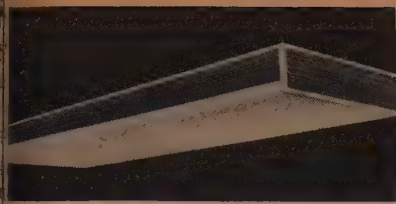
Federal Pacific Electric Co., 5 Paris St., Newark, N. J.

### Communications System

Two communications systems for nursing homes and senior citizens' retirement centers have been announced. One system is manual and the other is automatic. Both systems provide closer patient-nurse contact or staff-resident contact for communications, staff intercom, critical bedside monitoring, paging and facilities for emergency security and evacuation—alert signals and voice directions. With the deluxe automatic system, the rooms to be monitored are preselected on an associated annunciator panel. The master station is set and a monitoring is done individually and automatically with each room on a pre-determined time cycle.

DuKane Corp., St. Charles, Ill.





### Fluorescent Lighting (57)

A fluorescent lighting device combining oil-finished woods with engineered performance and prismatic glass diffusers for light control, has been announced. Called the Madera, it may be surface or stem mounted, individually or in rows. Unit is ideal for store, office, bank, or residential areas. To coordinate with this fixture is a companion wall unit with matching construction, performance, design; for use in corridors, mounted on walls, or close to ceiling, or individually over hospital beds, desks, merchandise displays, restaurant booths, couches and other areas. Literature is available.

Silvray Lighting, Inc., 100 W. Main St., Bound Brook, N. J.

### Photoelectric Set (58)

Beam-O-Lite is a ready-wired photoelectric set, available with either a counter or an alarm. It is designed especially for rough, industrial service. It can be used to count anything or signal an alarm when the beam of light is interrupted or established. Condulet-type housing is employed for both the exciter lamp and photoelectric receiver. Both units are protected against water spray, oil and dirt and can be operated indoors and outdoors. Since receiver unit includes control relay, cables can be extended any length desired.

Strandberg Engineering Laboratories, Inc., 1001 South Elm St., Greensboro, N. C.

### Intercom System (59)

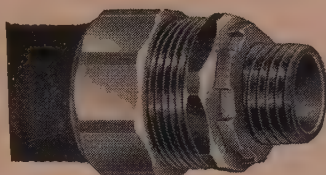
A completely transistorized intercom system, Protecto-Com, is designed for industrial as well as residential use. The entire system is powered by a door chime transformer. It incorporates a door answering service from an indoor station with room-to-room communication at all times. It includes transistor amplifier, indoor station, outdoor or outer office station, 50 ft of 8-conductor cable and 50 ft of 2-conductor cable.

Progress Webster Corp., Rochester 21, N. Y.



## VAP-OIL-TITE CONNECTORS

- for use with liquid-tight flexible, metallic conduit
- absolute water and oil-tight seal — vapor, dust, grit can't penetrate

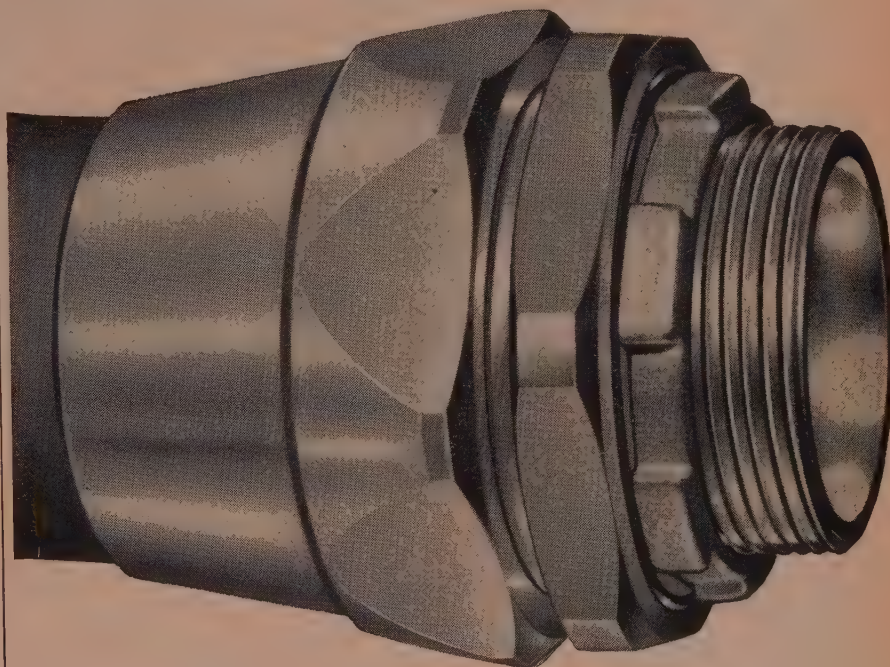


#### STANDARD SIZES — 3/8" to 2"

Available in 3 styles — straight, 90° angle and 45° angle. U.L. and J.I.C. approved. Fit both EF and UA conduit. Seven sizes for each style from 3/8" to 2" conveniently packaged in lots of 5 to 100, or by carton...priced right!

#### LARGE SIZES—2 1/2", 3", 4"

Straight style only. Double O-ring neoprene seals prevent foreign matter penetration—nothing can get through! Extra long skirt prevents damage to conduit. Three sizes, 2 1/2", 3" and 4" packaged individually — at the right price!



#### EASIEST TO APPLY--NEVER PULL APART

The *only* completely reusable connectors for OEM, replacement and maintenance, and machinery applications where a positive seal against water and oil is a must!

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"Are they\*  
delivered ready to  
install?"

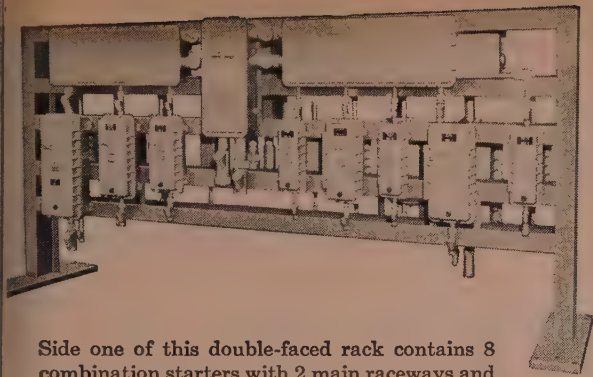


### \* KILLARK SWITCH RACKS

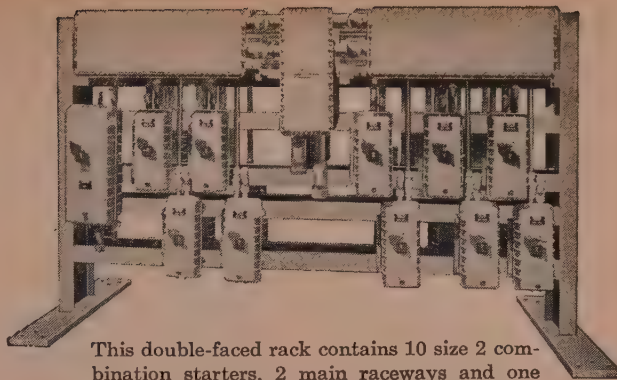
This rack is 20 feet long, 7½ feet high, and weighs 8700 pounds. Side one, shown here, contains 18 combination starters, with wiring through 4 raceways. Main terminal blocks are placed in a junction box. Side two (in back) contains 17 combination starters with terminal box and 4 raceways. Galvanized steel mounting frame is painted with two coats of zinc-rich paint. Built in accordance with N.E.C. Code, Article 500, governing Class 1, Group D, Division 1, hazardous areas.

**Killark**  
ELECTRIC  
MANUFACTURING  
COMPANY





Side one of this double-faced rack contains 8 combination starters with 2 main raceways and one main terminal box. The back side contains similar equipment. Total estimated weight 4,952 pounds. Length 15', height 7'10".



This double-faced rack contains 10 size 2 combination starters, 2 main raceways and one main terminal box on each side. Weight 4,828 pounds, height 7'10".

**"You bet they are!  
Designed, assembled, wired,  
sealed, shipped. Ready to  
hook up to power."**



"Les Sparks"

Killark's Bob Grimm, Assistant Sales Manager, is shown on the opposite page, by one of four (front-back) switch racks recently built for a Texas oil refinery. Two others are illustrated above.

All-aluminum control centers are custom-designed by Killark engineers from the broad selection of Killark enclosures: motor starters, disconnect switches, circuit breakers, panel boards.

Killark switch racks offer several really big advantages. Because they're aluminum, they're lightweight, rust-proof, non-sparking. They're versatile; you can specify them as large or small, as simple or complex as you require. They can be built for indoor or outdoor location, for hazardous or non-hazardous environments. All boxes are ribbed for higher strength and faster heat dissipation, rectangular for more compact assembly, front-opening for easier access and servicing.

Killark does practically all the work for you, from blueprints to assembly to wiring to sealing to shipping. The racks arrive at your plant ready to hook up to your power.

If you would like further information about Killark custom-assembled switch racks, drop us a line and we'll be happy to give you complete details.

Vandeventer and Easton Ave. St. Louis 13, Mo.

In Canada: Killark Electric of Canada, Ltd., 421 Islington Ave. South, Toronto 18, Ont.

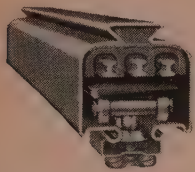


# NEW FEEDRAIL®

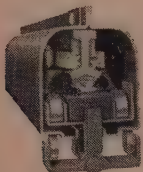
## STEEL ENCLOSED 4 and 5-POLE ELECTRIFICATION SYSTEMS

### SAFE for

- Crane Bridge and Monorail-Hoist Control Circuits.
- Power and Control Circuits on Low-tonnage Monorail Systems.
- Moving Power Take-off on Conveyorized Electrical Test Lines.
- Control of Power and Control Circuits on Machine Tools.
- and other applications requiring a Multiple Conductor Moving Power Source.



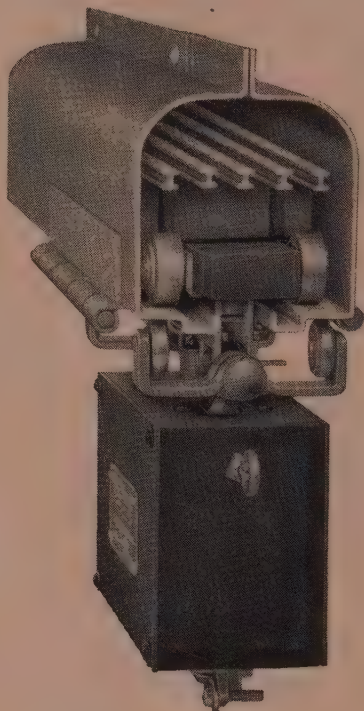
**FEEDRAIL "60"** — For low-tonnage hoists, cranes, portable tools, lighting, business machines, cutting and sewing room equipment, etc. Continuous rating—60 amperes. Intermittent rating—90 amperes. Send for Bulletin No. 90.



**FEEDRAIL "100"** — For cranes and hoists, stackers, portable tools, production and test lines, machine tools, hangar doors, etc. Continuous rating—100 amperes. Intermittent rating—150 amperes. Send for Bulletin No. 85.



**FEEDRAIL "HEAVY DUTY"**—for heavy duty cranes and hoists, large machine tools, conveyor assembly lines, etc. Continuous ratings—225, 375 and 500 amperes. Send for Bulletin No. 80.



Feedrail® steel enclosed 4 and 5-pole Systems are the modern, safe way of providing electrification where multiple conductors are required for moving or movable equipment.

Designed primarily to counteract unsafe and exposed wiring methods on crane bridge and monorail-hoist control circuits, these Systems adapt themselves to many other uses in new plants or as replacement of hazardous equipment in existing plants.

Fool-proof safety features have been incorporated to protect operating and maintenance personnel and plant equipment. You'll find its long life, low maintenance and dependable service economy factors in plant operation.

Completely standardized units, accurately and ruggedly constructed, are factory assembled for quick, easy installation. Just connect the units together to form runs of any required length or curvature. Its compactness permits a variety of mounting possibilities. By means of parallel runs, any number of conductors can be obtained.

Track sections are rated at 60 amperes per pole continuous service; trolleys at 15 amperes per pole. For complete data send for Bulletin No. 95.

## Catalogs & Bulletins

(60) **STREET LIGHTING.** 8-page Bulletin GEA-7689 describes no luminaire and transformer assemblies for residential underground distribution systems. General Electric Co.

(61) **POLARIZING PANELS.** 8-page Brochure OD-1071 entitled "Polarizing Light Panels" includes no technical description of polarization, recommended uses and benefits of polarized light. Dabrite Lighting, Inc.

(62) **BALLASTS.** 32-page catalog describes ballasts for fluorescent lamps for all indoor, and outdoor commercial, industrial and residential applications. Universal Manufacturing Corp.

(63) **CAPACITORS.** Bulletin GE 3553 describes 50- and 100-kva 2400-volt units for underground installations for single and 3-phase primary circuits, 60 cycles, 2.4 and higher kv, or 3-phase secondary network systems, 60 cycles. General Electric Co.

(64) **FLOODLIGHTS** to meet all lighting needs are illustrated in 4-page pamphlet including full line of mercury vapor and quartz-iodine outdoor floodlights and the mercury vapor indoor luminaire. Widelite Corp.

(65) **CIRCUIT BREAKERS,** panels, boards, safety switches, multiple dwelling service equipment and transformers are described in 44-page Product Digest. Zinsco Electrical Products.

(66) **LIGHTING.** 10-page booklet describes lighting equipment for parking areas, malls, building facades and signs that will enhance any style shopping center. J. H. Spaulding Co.

(67) **CAPACITORS.** 12-page Bulletin GEA-7197 describes 100-kvar capacitor units for pole-top and open rack applications, plus additional equipments such as stack-rack equipment. General Electric Co.

(68) **ELECTRIC POOL HEATING.** Chromalox electric pool heating equipment for use in new and existing swimming pools is presented in Bulletin PE-102-3. Edwin I. Wiegand Co.

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SPECIALIZED QUALIFIED REPRESENTATIVES IN PRINCIPAL CITIES



(9) SAFETY SWITCHES, load centers, metering equipment, circuit breakers, lighting panelboards, power and distribution panelboards and bus duct systems are covered in 132-page 1962 Speedfax catalog. T-E Circuit Breaker Co.

(70) LUMINAIRE. 4-page Catalog TG-35 describes the HO series on their LUXaire luminaires which are four-lamp assemblies available in 4, 6 and 8 ft sizes. Pfaff & Wendall.

(71) EPOXY-WRAP METHOD for cable splicing, terminating and repair is described in 16-page Bi-Cast ED-2 brochure. Bishop Mfg. Corp.

(72) OUTDOOR HOUSINGS. Standard all-steel and aluminum outdoor housings for 5- and 15-kv switchgear are described in Bulletin 8C1124. Allis-Chalmers Mfg. Co.

(73) CLOCK, program and communications systems, emergency lighting equipment and fire alarm systems are covered in 8-page Catalog 254. Standard Electric Time Co.

(74) EXIT LIGHTING. Bulletin No. EX2-462 contains information about exit lighting units illuminated with fluorescent or incandescent lamps. Art Metal Lighting Div., Wakefield Corp.

(75) EXPLOSION-PROOF HOUSINGS. 36-page Bulletin 562 lists expanded line of UL-listed cast-aluminum, explosion-proof housings, boxes and fittings. Adalet Mfg. Co.

(76) LIGHTING. 60-page Catalog W-462 includes complete specifications on commercial and industrial lighting units—fluorescents, incandescents and luminous ceilings. Wakefield Lighting Div., Wakefield Corp.

(77) OUTDOOR LIGHTING. 48-page Brochure GEA-72223A entitled "Area Lighting Designer's and Buyer's Guide" describes line of mercury, fluorescent and filament luminaires for area lighting. General Electric Co.

(78) TELEPHONE SYSTEM. New bulletin describes private automatic telephone systems. Communications Systems Div., Dukane Corp.

(79) LIGHTING. 12-page brochure describes complete line of recessed and wall mounted residential lighting fixtures. Marvin Electric Mfg. Co.



ACCENT ON VALUE

# 3 PHa- SE

load centers to 200 amp  
with "TWIN"\* breaker  
flexibility



Now, a full line of 3-phase, 4-wire load centers with 12 to 42 circuits, 125, 150 and 200 amperes. Sequence phased for maximum versatility, these 1, 2 and 3-pole breakers save installation and maintenance time, reduce cost. Another G-E product development to make your job easier, more profitable.

For complete information, call your G-E Distributor today. Or write General Electric Company, Circuit Protective Devices Department, Plainville, Conn.

\* Trade Mark

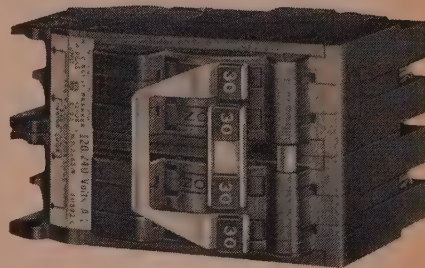
GENERAL ELECTRIC



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# 30 AM- pere "TWIN"\*

gives you two 30-Amp,  
240 Volt Circuits in  
the space of one



New double 2-pole "TWIN" allows two 240 volt circuits in the space of one conventional size two pole breaker. Save time and space, increase efficiency. Also available in 15 and 20 amp. ratings. Another new G-E product development to make your job easier, more profitable.

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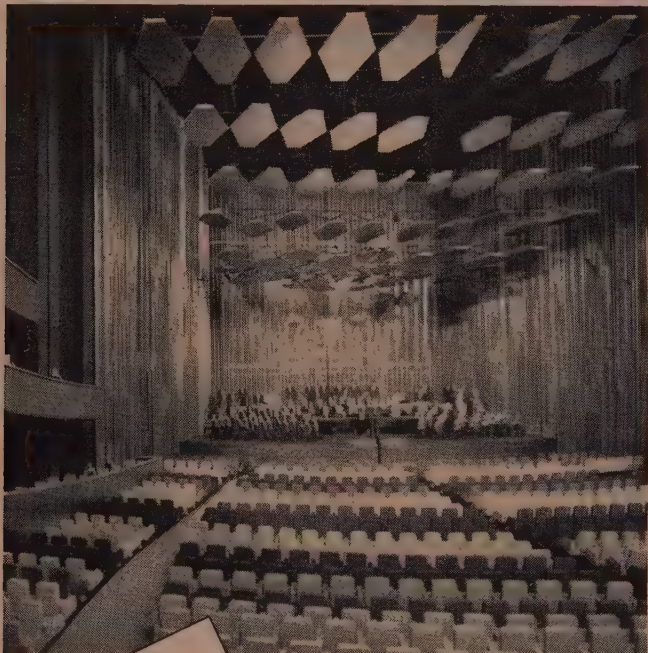
\* Trade Mark

GENERAL ELECTRIC



# Lighting News

AT **PHILHARMONIC HALL**  
IN NEW YORK'S LINCOLN CENTER  
FOR THE PERFORMING ARTS



Max Abramovitz, Architect

...another  
installation  
by **KLIEGL**

Keynoted throughout by newness, this showcase of the symphony introduces a wide range of stage and interior lighting innovations. Designed by Richard Kelly—and developed and produced by Kliegl Bros., lighting at the Philharmonic promises to establish trends for years to come.

Though yours may be a project far different from a Lincoln Center, the same Kliegl assistance is available to you. The experience of more than half a century can be applied to your lighting whether the job is small or large. Our broad knowledge and skill in optics and reflector design can provide a solution for any lighting application. You gain important savings in time and money *plus* long-term satisfaction. There is no obligation—call on your Kliegl representative or write us direct today.

Our lighting advisors will be pleased to assist in the planning of any installation, using standard or special units to meet your requirements. Full details on request.

lighting

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2-311

## ESTIMATING FORUM—XXIII

[FROM PAGE

timating Forum—XXII (pg. August, 1962, *Electrical Construction and Maintenance*).

While there are no multipliers in the table for a \$600,000 contract price, those for a \$625,000 project are close enough to serve our purpose. The spread between multipliers for the \$315,000 and the \$625,000 projects is not great. The spread between the \$600,000 and \$625,000 jobs is much less.

### Cost Factors

Now, using the relevant multipliers in Fig. 1 for the \$625,000 project, we get the following results:

1. *Base Job Cost*. 0.80 (Col. 9)  
\$600,000 = \$480,000.

2. *Base Cost of Material*. 0.48 (Col. 10)  $\times$  \$600,000 = \$288,000. Since the project MLR is 60/48, this figure can be easily checked by taking 60% of the base cost (\$480,000) determined above.

3. *Base Cost of Labor*. 0.32 (Col. 11)  $\times$  \$600,000 = \$192,000. If the base job cost has been calculated, this labor figure can be checked in two ways: (1) take 40% of the base job cost; (2) subtract the base material cost from the base job cost.

4. *Man-Hours of Labor*. 0.08 (Col. 12)  $\times$  \$600,000 = 48,000 hours. The total labor hours can also be figured by dividing the base labor cost by the \$4.00 per hour rate. But that means that the base labor cost will have to be determined first.

### Asset of Multipliers

The advantage of using the Fig. 1 multipliers is that any one of the base cost factors (job, material, labor) or total man-hours can be quickly determined when only the project contract price is known. It can save considerable time.

Thus far, this analysis answers the questions regarding division of a project's base cost. In addition, the contractor must know over what period of time this cost will be distributed; also what the average and maximum manpower (crew size) requirements will be. These subjects will be covered in the next article.



# Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installations, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay \$5.00.

## Fire Stops For Vertical Busway

**QUESTION K41**—*In an electrical installation using vertical busway, are there any code ruling on providing fire stops on the exterior or the interior of the busway? On the exterior when going through a floor, is concrete sufficient or must we use noncombustible floor material?—J.S.*

**ANSWER TO K41**—Section 300-21 of the National Electrical Code states that all electrical installations shall be made in such a manner as to reduce to a minimum the spreading of fire through fire-topped partitions, hollow spaces, fire walls or fire partitions, vertical shafts, ventilating or air conditioning ducts and between buildings.

In our power busway and wireway installations, we provide a firestop between floors, fire walls and between buildings.

We do not use concrete for these fire stops because concrete absorbs water and could in time short out our power busway. We use a noncombustible epoxy having high dielectric and bond characteristics.

Due to a large number of epoxy encapsulated motors in operation, quite a few bonding resin manufacturers offer suitable material for providing a good fire stop in busways and wireways. However, your local inspection authority should be consulted as to the accepted procedure in your area.—H.E.H.

**ANSWER TO K41**—About the only rule in the NEC that would apply to your question is Section 300-21, which states that electrical installations shall be made to minimize the possible spread of fire through fire-stopped partitions, etc. However, this code rule is quite general in nature and not too helpful in your particular case. With the advent of vertical busway risers in high-rise buildings, building and electrical inspectors have been concerned with the possibility of fire spread through these risers as well as any openings around the outside of a metal busway where it passes through floors and ceilings. Unless

such openings are closed, an up-draft is created, which has a chimney effect in the event of a fire.

Because of this problem, several large cities have adopted standards that would apply in your case. More recently, the Chicago Electrical Inspection Bureau has announced approval of two alternate methods for providing a suitable fire cut-off: "(1) Openings shall be filled with approved noncombustible material. Approved noncombustible material is a material which will not ignite when heated to a temperature of 1200°F, or (2) Openings shall be closed off by close fitting metal caps at the ceiling and floor lines. Suitable cut-offs against vertical travel of fire shall be installed within ventilated and unventilated vertical busways. Internal vertical busway fire stops shall be so located that vertical travel of fire from one story to another is effectively prevented." As a recommendation, I would suggest that you use metal caps to cover any openings around the outside of the busway where it passes through floors and ceilings. Inside the busway the fire stops should be high-temperature, high-dielectric material.—H.S.

## 3-Phase Loads on Single-Phase Supply

**QUESTION L41**—*We need a 3-phase 115-volt supply (about 0.1-amp load) for testing at places that have only a single-phase supply. Could someone supply me with the necessary information for constructing such a converter?—H.G.R.*

**ANSWER TO L41**—The best solution to your problem would be to buy a reliable unit, properly engineered and factory made; the time and effort saved will justify the cost. These converters are available as shown in an ad on page 163, *El C&M*, June 1962, Add-A-Phase, Dept. ECM-6, Div. System Analyzer Corp., Nokomis, Ill.—J.A.

**ANSWER TO L41**—A 3-phase 115-volt power supply can be built up

using electronic components; however, for most electrical 3-phase measurements it would not be suitable. The harmonic content of such a device would be excessive.

You can purchase an "Add-A-Phase Unit" which converts single-phase power to 3-phase power.

You can also contact a fractional-horsepower motor manufacturer and have them build up a small synchronous-drive motor-generator set.—H.E.H.

## Cadmium Rod Tests

**QUESTION M41**—*Many years ago I spent my spare time in an auto battery repair and charging station. At that time the battery often gave out in six months or so because of wooden separators and shedding. It was common to tear them down and rebuild them.*

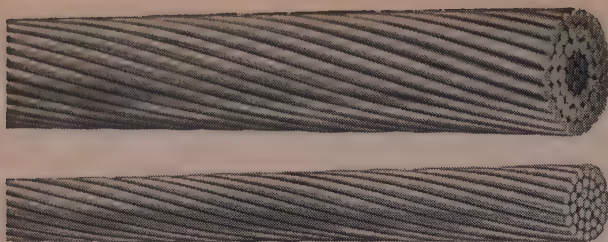
*To test the condition of plates they used a cadmium rod dipped into the electrolyte and took a voltage reading from it to both plates.*

*I cannot remember what the voltage should be and cannot find a mention anywhere in text books. Others I have asked do not know the answer.—H.D.B.*

**ANSWER TO M41**—In the cadmium rod test by using a high resistance accurate voltmeter we got a negative cadmium discharge of about 0.2 volt. On charge negative 0.13 volt. On positive charge 2.4 volts. And on positive discharge 1.95 volts. These figures are approximate and are described in the 1941 Standard Handbook For Electrical Engineers. The new rods have to be immersed in electrolyte for several days and then for five or ten minutes before using if allowed to dry.—H.S.

**ANSWER TO M41**—When a cadmium rod is placed across the top of the plates in a cell and properly insulated from them, there will be a difference of potential between the positive plates and the cadmium and between the negative plates and the cadmium. The difference between these two readings is equal





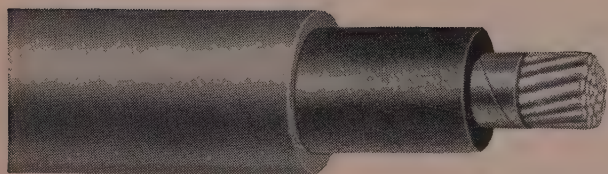
**Bare Solid and Stranded Conductors—**Aluminum, copper or ACSR in complete range of sizes, tempers, and constructions.



**Weatherproof Line Wire—**Aluminum, copper or ACSR conductors. Polyethylene and neoprene coverings available.

# REYNOLDS

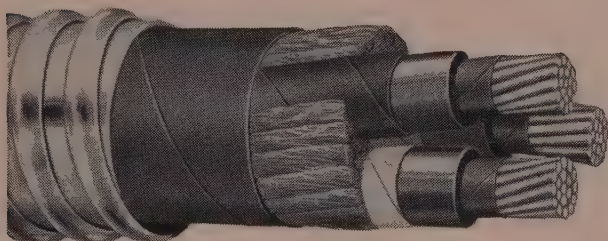
## Complete range of types and



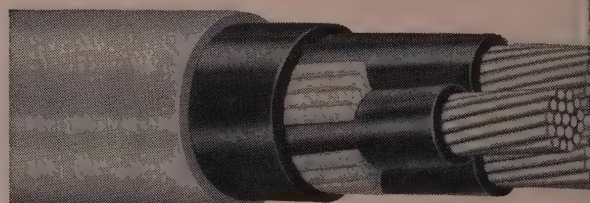
**Rubber Insulated Neoprene Jacketed (Non-Shielded) Cable—**For conduit, trays, troughs, underground duct, aerial, and direct burial. Aluminum or copper conductors. Up to 5,000 volts.



**Pre-Assembled Self-Supporting Aerial Cable—**Aluminum or copper conductors. Rubber insulated shielded or non-shielded, neoprene jacketed. Regular or reverse lay construction. 0-15,000 volts. Various messenger choices.



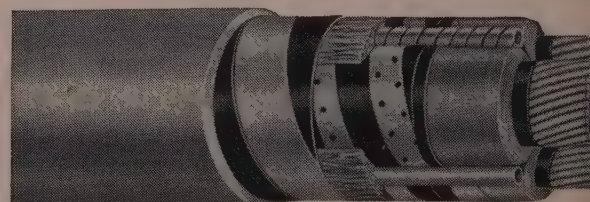
**Interlocked Armored Cable—**Single or multiple constructions of copper or aluminum conductors. Various insulations and types of armor available.



**Varnished Cambric Cables—**Aluminum or copper conductors. Up to 28,000 volts. Braided lead sheathed.

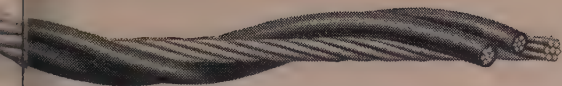


**Rubber Insulated Neoprene Jacketed (Shielded) Cable—**Single or multi-conductor constructions. Copper or aluminum conductors. Ozone resistant butyl insulation. Temperature rating 85° C. 5,000 to 15,000 volts.



**Low Pressure Gas-Filled, Paper Insulated, Lead Covered Cables—**Aluminum or copper conductors. Self-supervising system. 0-46,000 volts. Tellurium lead sheath with or without protective coverings.



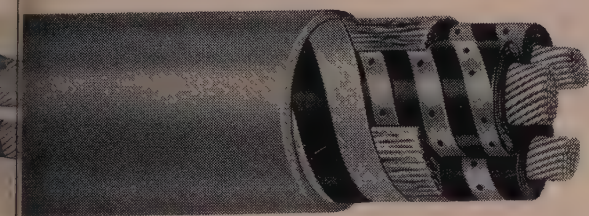


**Supporting Service Drop and Secondary Cable**—Aluminum or copper conductors insulated with polyethylene or neoprene. Choice of sizes.

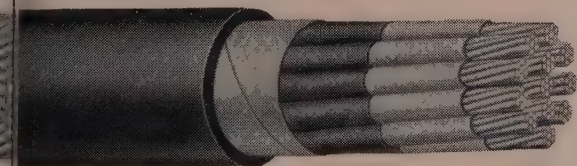
**Underground Service Entrance Cable**—Single or multi-conductor constructions. Aluminum or copper conductors. For wet or dry locations. Type USE, Style RR, 75° C.

# POWER CABLE

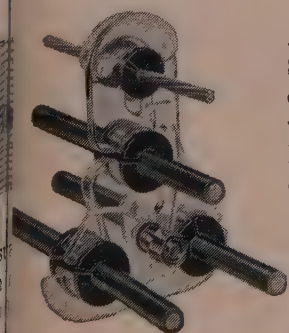
izes to meet your specifications



**Lead Type, Paper Insulated, Lead Covered Cables**—Single or multiple conductors of aluminum or copper. Tellurium lead or copper bearing lead sheaths with or without outer protective rings. 0-69,000 volts. Manufactured in accordance with latest AIEE specifications or to meet customer requirements.



**Control Cables 600 Volts**—Available in a complete range of types and sizes to meet your specifications.

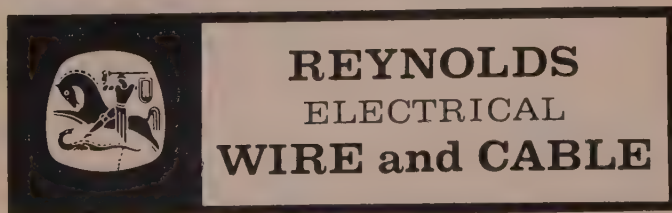


**Aerial Cables and Spacers**—Aluminum or copper conductors, with various coverings. Highly engineered, molded plastic spacers. For 5,000 through 15,000 volt circuits.

Now—Reynolds can offer one of the most complete packages in the industry! Choose from a wide range of insulated wire and cable; bare overhead transmission cable; bus bar; substations and towers; aluminum conduit; condenser tubes; building products. In addition, these special services are available to Reynolds customers: engineering assistance and on-the-job consultation; design and fabrication assistance; research and laboratory facilities for product development. And, you can always count on fast delivery of your electrical product needs. Contact your Reynolds Distributor, Reynolds Sales Office, or write *Reynolds Metals Company, P.O. Box 2346-ET, Richmond 18, Virginia.*

For details send for brochure, "Reynolds Electrical Products." See address above.

All Reynolds wire and cable meet or exceed the requirements of standard industry specifications



Watch Reynolds exciting TV program on NBC: The Dick Powell Reynolds Aluminum Show Tuesday nights. SPECIAL: See the 1963 cars on the color telecast of The National Automobile Show direct from Detroit on Sunday, October 21, NBC-TV, 6:00 to 7:00 p.m., EDT.





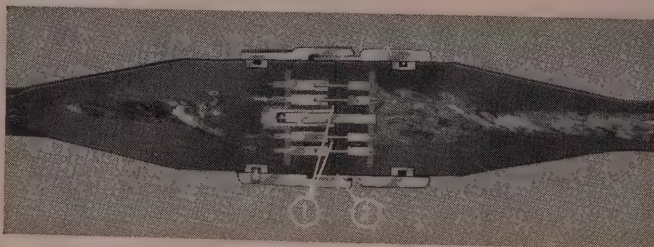
## TREAT 'EM ROUGH! . . . but count on complete reliability 'from Joy electrical connectors

Many connectors handle "garden variety" jobs, but none can take rough, tough daily abuse like Joy. They're deliberately designed to stand up under the most severe conditions, electrically and mechanically.

Molded-to-cable in resilient Neoprene, Joy connectors harmlessly absorb shock, vibration, impact, distortion . . . and remain performance perfect. In undersea applications, they remain watertight. In oil wells, they withstand pressures at 20,000 psi. They carry voltages over 7500.

In short, Joy connectors save you money through longer life, less downtime, fewer repairs.

**Watertight feature is standard with Joy**  
Cross-section shows 26-pole engaged connector. Note (1) contact "cork" seals on every conductor, and (2) integrally molded "O" ring face seal.



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Division

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# JOY

to the voltage of the cell. In normal cell there is a well-defined relation between these readings both on charge and discharge—any appreciable variation is an indication of irregular action either the positive or negative plates, depending on which reading shows the variation. The positive cadmium reading will usually range from about 2.15 volts down to 1.95 volts during a discharge at the 8-hour rate, and from about 2.20 volts up to 2.50 volts during charge. The range for the negative cadmium reading is from about 0.15 volt at the beginning of discharge to about 0.30 volt at the end. During charge the negative range is from about 0.15 volt —0.20 volt (0.20 volt reversed polarity) with new or nearly new plates. As the plates age, the reading at the end of charge diminishes to about zero volts. Use an accurate high-resistance voltmeter for this testing procedure. There are a number of other aspects to the problem which should be reviewed but are too lengthy to be discussed here. You can obtain all the details by referring to Volume 3 of "Aids Electric Library," McGraw-Hill's "Standard Handbook for Electrical Engineers," or requesting information from one of the major battery manufacturers. D. J. G.

## Use of Conductors In Underground Conduit Runs

**QUESTION N41**—In the design of underground power distribution systems, I have encountered conflicting opinions and would like to hear what some of the experts in this field have to say.

Most of the designers try to get a "dry" conduit system. They carefully arrange all conduit runs to slope and drain into the manholes; expensive watertight covers are specified; and manholes are waterproofed, etc., to prevent the entrance of water.

Other men say that is a waste of money. Water will sometimes enter ducts and manholes even if the preventative steps, mentioned above, are taken. They insist, that under average conditions, water in ducts and manholes will not harm good cables which are properly installed; the cooling effect of water is very beneficial and will prolong the life of the cable.—J.A.





**NEW LAMPS COME IN**  
this side of Caddy-Pack



**OLD LAMPS GO OUT**  
this side of Caddy-Pack

## Now there's an 8-foot Sylvania Caddy-Pack!

(Could group relamping be easier than this?)

Above you see another great moneysaving idea from Sylvania. An 8-foot Caddy-Pack that lets you roll 24 new Lifeline lamps into your lighting area safely, conveniently—and lets you roll out 24 replaced lamps in the same container!

It's a new version of the 4-foot Caddy-Pack, greatest efficiency unit ever designed for group relamping. Only difference...

4-footer stands up, 8-footer lies flat. And both contain sensational new Sylvania 9000-hour Lifeline fluorescents—each with an exclusive etch on glass for recording date of installation.

These are just two more examples of how Sylvania brings you lowest possible TCL—Total Cost of Lighting. With money-saving methods. Brighter, longer-lasting lamps. And an exclusive Sylvania money-

back guarantee that states: "If at any time a Sylvania Fluorescent Lamp fails in your opinion to provide better performance than any other brand fluorescent lamps, on the basis of uniformity of performance, uniformity of appearance, maintained brightness and life, it may be returned to the supplier for full refund of purchase price."

See your Sylvania representative for Caddy-Packs. Or write: Lighting Division, Sylvania Electric Products Inc., Dept. 15, 60 Boston St., Salem, Mass.

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you could lose  
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## PUT KIDDE FIRE DETECTION ON THE JOB!

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The Kidde FYRINDEX Detection System is built around the compact Detector unit shown above. Expandable, this modern system can protect a single booth or a whole complex of buildings. FYRINDEX responds quickly, operating on both fixed temperature and rate of rise principles. Can be heat tested repeatedly; is self-resetting; no parts to replace. Paintable. Dust, humidity, corrosive air particles can't impair its efficiency. Its long-lived reliability makes it especially popular with servicing personnel.

**EASY TO INSTALL** Components include FYRINDEX Spot Detector (each rated to cover 2500 sq. ft.), control box, distinct horn, and wiring. Mounts on standard 3½" box. Knockouts for surface and concealed wiring.

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Walter Kidde & Company, Inc., 985 Brighton Road, Clifton, N.J.

**ANSWER TO N41**—You touched on a topic that will all reveal differences of opinion among engineers, contractors, others interested in underground conduit installations. The reason for these varied opinions are many different earth conditions exist in various parts of the country. And too, much depends whether the conduit is metallic, nonmetallic and how it is installed in soil conditions; and whether water contains acid or alkali. I face it. It is extremely difficult to exclude water permanently from underground conduits. In my opinion, an important factor in selecting the proper conduit system and conductors that will best satisfy the field conditions under which they will be used. What is good in one area could be poor for another. Experience in a certain area reveals the logical selection of underground wiring materials, installation techniques in the locality. And it is common knowledge that nature's variables play a part in conduit and cable manufacture.

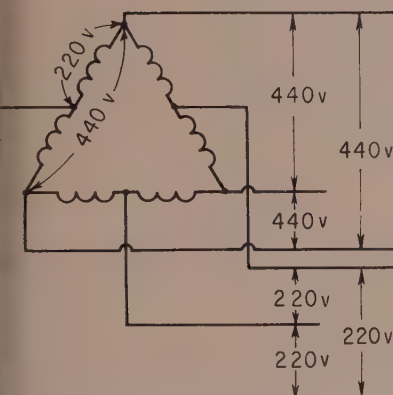
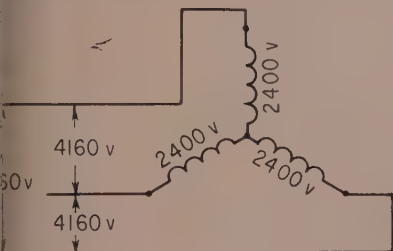
As posed in your question, both the "dry" and "wet" underground installations have proved successful in your area, then you have no problem. Use either method, applying the law of economics in conjunction with sound engineering practices. But with the latter it should be realized that many phases of engineering simply cannot be stereotyped for all parts of the country, and this philosophy applies to underground installations because of the many variables involved.

While water would have a cooling effect, it could also deteriorate certain insulations or sheaths if the water contains acid or alkali. For my own part, I prefer to maintain the underground conduit system watertight as possible, giving careful attention to the slope of run so as to allow drainage of water and condensation. If water can enter the conduit system too readily, so will muddy earth sediment, some of which can be harmful to the cable insulations. In extremely poor soil conditions it is best to use high quality insulated conductors (such as neoprene-jacketed Type US) in the conduits. Under more favorable conditions standard moisture-resistant, rubber- or thermoplastic-insulated conductors will do the job satisfactorily. At potential over 600 volts, consult an application engineer or a cable manufacturer.—J. L. C.



## Can You Answer These QUESTIONS?

**QUESTION V41**—Below is a diagram of three 100-kva 2400 to 220-volt transformers to provide 220 volts and 440-volt 3-phase power for a shop. The primary is connected for 4160 volts and the secondary is delta connected for 220-volt, 3-phase. The 220-volt 3-phase is taken from the center taps of the transformers.



The 3-phase 220-volt load will be approximately 150 kva and the 440-volt 3-phase will be used for checking motors up to 200 hp.

What kva load can be taken from the 220-volt 3-phase buses without damaging the transformers, assuming no load is taken from the 440-volt buses?

Also, I would like to see a vector diagram of the current and voltage with a load taken from both buses.

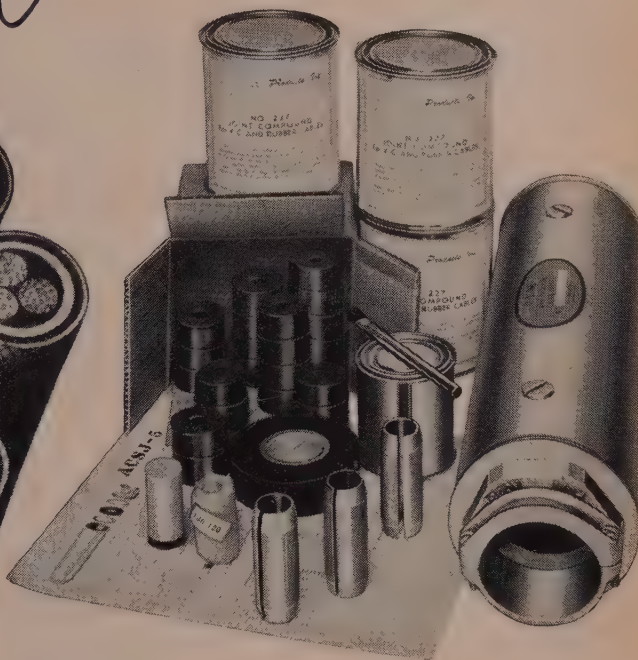
—G.A.W.

**QUESTION W41**—As a rule, which is preferred for switching 60-cycle circuits—a switch mechanism or quick-make, quick-break; slow-make, slow-break; or slow-make, quick-break? I hear a lot of differences of opinion on this subject.—R.S.

PLEASE SEND IN YOUR ANSWERS BY OCTOBER 15



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**We ring the necks of our bolts.**



**They stay put and make OKLIP connectors easy to install.**

Black neoprene rings keep OKLIP® bolts from dropping off during installation. When you have a full day of heavy duty service connecting, time is precious. This is one way of saving it. Along with a little money.

Funny thing about OKLIP. The more you tighten it, the smaller it gets. Compact construction and rounded edges make taping OKLIP a snap. It's an amazing service connector.

Construction is of high copper alloy. The bolts provide high contact pressure between conductors and insure strong, low resistance joints.

You won't find a service connector quicker or easier to install. So don't look. Contact your Burndy distributor for details.

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Norwalk, Connect.





Answered by:

**J. C. HEWITT**, Chief Electrical Inspector, Department of Labor and Industries, State of Washington, Olympia, Wash.

**R. L. LLOYD**, Electrical Safety Engineer, National Bureau of Standards, Washington, D. C.

**B. Z. SEGALL**, Consulting Electrical Engineer, New Orleans, La.

**R. E. WARD**, Chief Electrical Inspector, Insurance Department, State of Tennessee, Nashville, Tenn.

READERS are invited to submit questions regarding the National Electrical Code and its practical application to this Department. Questions are answered by the consulting editor whose initials appear at the end of each item. The views and opinions expressed are, in each instance, those of the individual consultant replying and are not necessarily those of his employers, of this publication or of a Code-making committee or panel on which he may serve in an official capacity.

## Class III Installations

**Q.** Is a raintight enclosure suitable for a service-entrance switch in Class III areas?—*R.M.B.*

**A.** It should be noted that Underwriters' Laboratories, Inc. in its "Hazardous Location Equipment List" does not specifically list materials for Class III locations. It does, however, make the following general statement relative to Class III equipment:

"Equipment listed for Class II, Group G hazardous locations is also suitable for use in Class III Locations, except fan-cooled type motors when there is a very large amount of lint or combustible flyings which are liable to choke or clog the air passages of the motor."

The manufacturers of this hazardous location equipment, however, do show in their catalogs various fittings, etc., which they say are listed (by UL) for Class III locations. Furthermore they show that these items are also raintight; for example, the Type "GUB" junction boxes as manufactured by Appleton, Crouse Hinds, etc. However, these same manufacturers make a line of junction boxes, which are "raintight" but are not approved for Class III locations, viz., the "RS" series. This will be true for many other types of fittings, equipment, etc., manufactured by these specialists in the field of hazardous location devices.—*B.Z.S.*

## Panelboard Ratings

**Q.** Under Section 384-15 the number of overcurrent devices of a lighting and appliance branch-circuit panelboard is limited to 42. No mention is made of the rating for such panelboard.

What would be the maximum rating of a switch or circuit breaker placed ahead of or made as a part of such panelboard?—*J.M.W.*

**A.** Generally speaking, inspection authorities follow recognized standards and check equipment to see whether or not such equipment is listed by a recognized testing agency or laboratory, such as Underwriters' Laboratories, Inc. The UL standard for panelboards does not specify a maximum rating for the mains of lighting and appliance panelboards. Such standard does require that the rating shall not be more than the current-carrying capacity of the main busbars or the capacity of the main switch or main circuit breaker if such is provided as part of the panelboard. There are minimum ratings that are permitted according to the total number of lighting and appliance branch circuits, and if busbars of greater capacity than the minimum required are used the rating of the panelboard may be similarly higher. Therefore, in answer to your question, the rating of the busbars in the equipment would determine the size main switch or main circuit breaker that should be used.—*R.E.W.*

## Derating Branch Circuits

**Q.** In a store building, continuous-row fluorescent luminaires constitute the overhead lighting with the ballasts designed for connection to 120 volts. Each row of fixtures will be served by a 4-wire, 208Y/120-volt, 20-amp branch circuit consisting of 12/4 armored cable run from the panelboard to the first fixture of each row. The fixture load will not exceed 16 amps for each 20-amp circuit, which seems to satisfy the provisions of Paragraph 210-23 (b) since this code rule limits the branch-circuit load for store lighting to 80% of the branch-circuit rating. However, we have been told that the maximum load must be

reduced to 12.8 amps per circuit because of an additional code rule that requires another derating to 80% of the wire carrying capacity because of four current-carrying wires in a single cable. We would appreciate your opinion.—*C.D.B.*

**A.** To put this discussion in the proper perspective, let us look at each factor separately.

First, the 80% maximum load called for in Paragraph 210-23 (b) is to reduce heating in panelboards. By applying a 20% derating, more overcurrent devices (carrying smaller loads) and larger (or more) panelboards would generally be required. This will allow a safer distribution of heat in the panel and minimize needless operation of some types of branch-circuit overcurrent devices or damage to feeder or circuit conductors in the panel.

On the other hand, the neutral conductor of the 4-wire wye branch circuits supplying the fluorescent fixtures will carry about the same load as the three ungrounded conductors because of third harmonic currents in this type of circuit arrangement. Accordingly, four such current-carrying wires in a single cable or conduit require a reduction in allowable current-carrying capacity to 80% of the conductor rating per Note 8 to Tables 310-12 through 310-15. In this case, the derating concerns the aggregate heat of four current-carrying conductors in a single cable. The 20% reduction in load reduces the temperature rise in the cable and affords greater protection for the conductor insulation.

As a result, derating is necessary for two separate purposes. And in your case, applying the 80% factor only once will satisfy both objectives which ascribe to the same value. In other words, the maximum load on any of the 20-amp branch circuits cited in your question should not exceed 16 amps.—*J.C.H.*





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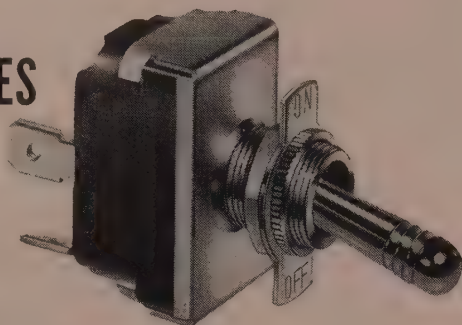
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## Non-Metallic Sheathed Cable

**Q.** Does anyone manufacture an approved 100-amp non-metallic cable that can be used as feeder?—G.C.

**A.** At the present time the code only permits up to a No. 1 AWG size. Such a cable with three copper conductors or less with even Type RHH insulation on the conductors would only be rated at 90 amps. See Table 310-12.

The 1962 Code, however, proposes to raise this to a No. 2. It will be noted that Table 310-12 will rate this cable with RH, RUH, RHW and THW insulated conductors of this size for 115 amps.

Incidentally, there has been a definite need for this larger cable. The installation of "all-electric" facilities in the many new apartment houses, motels, etc., throughout the country has necessitated the use of many make shift electrical installations because of the low-capacity rating of these non-metallic sheathed cables. It is hoped that even larger sizes may be permitted since many installations require, 125-, 150- and even 200-amp capacity for the individual apartments, etc.—B.Z.S.

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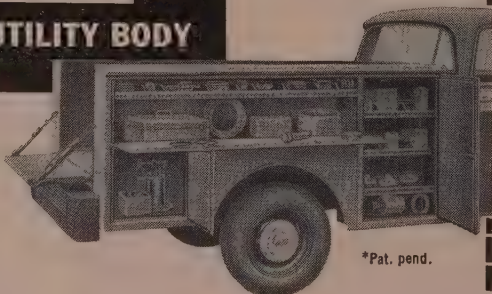


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## Branch-Circuit Voltages for Pole Lighting

**Q.** We have an outside lighting installation where floodlights will be mounted on poles. The supply will be underground wiring with approved materials, and properly protected where such wiring emerges from the ground and extends up the poles to the floodlights. The underground cable will contain a grounding conductor that will be used to ground the metal housing of the pole-mounted mercury-vapor lighting fixtures. The voltage will be less than 500 volts.

Does the code limit the voltage that may be used on such an installation?—I.P.

**A.** Official Interpretation No. 459 to the NEC reads as follows:

"Statement: A roadway lighting system serves the roads and driveways at a sewage treatment works. The wiring is underground in a trench and there is no question regarding its suitability. The branch-



circuit supply is 480 volts, 3-phase, ungrounded. It feeds fluorescent lamps operating at 265 volts. The lamps are mounted on standards, such as are commonly used for street lighting.

"Question: Is Section 2113 (210-6 of the 1959 edition) of the National Electrical Code applicable to this installation?

"Answer: No."

You will note from the above official interpretation that Section 210-6 is not applicable to this installation, which is practically the same question that you have asked.

In Article 730, "Outside Branch Circuits and Feeders," it will be noted that in several places mention is made of over 600 volts; therefore, by inference such would be allowed.

It is proposed in the 1962 edition of the code under Section 210-6 (a) that two exceptions be made, which, under certain conditions, will limit the voltage to 300 volts to ground. However, the two exceptions pertain to industrial establishments, for inside wiring such as office buildings, schools, stores, etc., and do not mention outdoor or outside floodlighting. Therefore, as recorded in O. I. No. 459, the section does not apply to a roadway lighting system serving the roads and driveways at a sewage treatment works. In my opinion, the installation described by you is not a code violation.—R.E.W.

## Grounded Conductor for AC Systems

**Q.** According to information I have received, the 1962 Edition of the Code will require a grounded conductor run to each individual service. Does this mean all installations shall have the grounded conductor run to each building that has a service?—J.F.M.

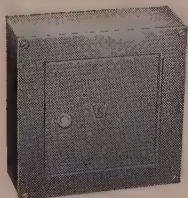
**A.** You have reference to Paragraph 250-23 (b) of the 1962 Code which states: "Where the secondary system is grounded at any point, the grounded conductor shall be run to each individual service. This conductor shall be not smaller than the required grounding conductor specified in Table 250-94 (a)." (This requirement becomes effective January 1, 1964.) You will note the requirement is mandatory where the secondary system is grounded at any point. In many areas this practice has been carried out for some time, and in some locations it is almost impossible to get



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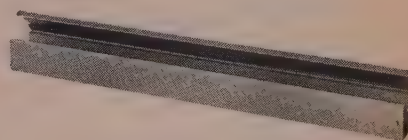
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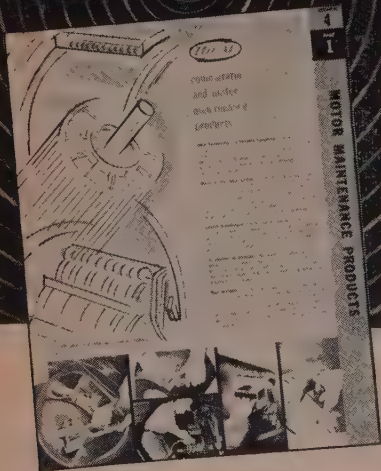
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effective grounding for equipment without a grounding conductor such as this rule will require. One statement made concerning this subject: If you are going to ground it at all, you have to ground it all the way. You have to go one way or the other. You can't go half way on it.

The purpose of the effective date was to give utilities an adequate amount of time to change their engineering practices where such practices are not in line with the requirement.—R.E.W.

## Rewiring Conduits

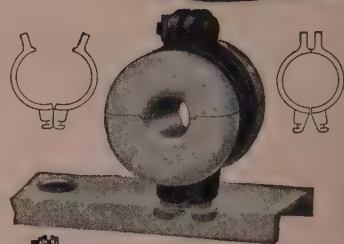
**Q.** We have a job to rewire existing conduits encased in a concrete slab of an industrial plant. It is our understanding that it is approved to rewire these conduits with TW conductors to a maximum fill of 50% where three or more conductors will be installed in each conduit. However, it appears to me that the allowable 50% fills apply only to concealed conduits after reading Table 3, Chapter 10. While the greatest length of each conduit run is concealed in the floor slab, all conduit runs do emerge exposed for a short distance at the panel-board and at columns or machines throughout the plant. The exposed part of the conduit runs at either end does not extend more than 5 ft above the floor. Because small portions of each conduit run are exposed as described, does this rule out using the 50% fill?—P.K.

**A.** Your analysis of increased fill being applicable to concealed raceways is correct. For the convenience of our readers, the statement concerning rewiring of existing conduits in Table 3, Chapter 9 reads as follows: "For rewiring existing raceways for increased load where it is impracticable to increase the size of the raceways due to structural conditions (the maximum conductor fill recommended is),—60% (one conductor), 40% (two conductors); and 50% (three or more conductors)." Official Interpretation No. 286 concerning the wording of this statement advised that it was applicable to concealed raceways only. Therefore, this confirms your understanding of the statement, in general.

However, it is my personal opinion that the short exposed "stubs" in the principally concealed conduit runs would not disqualify the use of the existing conduits for the increased conductor fill previously

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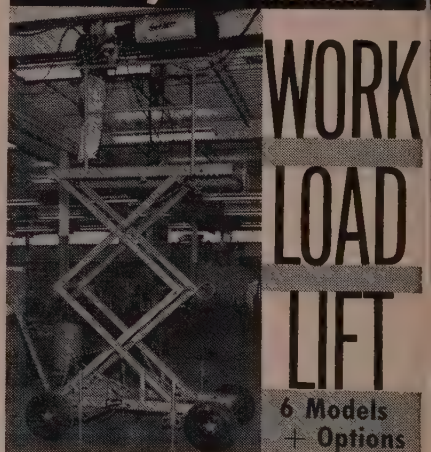
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described. It would appear that no useful purpose would be served if the short "stubs" were increased to a larger conduit size and then coupled to a smaller conduit in the concealed space.

In our inspection territory we would approve the 50% rewiring fill for the conduits described in your question, but you should seek the approval of your local inspection authority because they will have the final say in your area.—J.C.H.

## Surge-Protective Capacitors in Hazardous Locations

**Q.** Reference is made to Paragraph 502-3 of the NEC, which states that surge-protective capacitors are required in Class II, Div. 1 and 2, Hazardous Areas. The building under consideration falls in this category under Group E; however, the service equipment is located in a heater room which is separated by 4-in. walls and has no openings into the hazardous area. Under these conditions is it necessary to install surge-protective capacitors?

The code further states that "surge-protective capacitors should be of a type especially designed for the duty," etc. Manufacturers' catalogs available in this office contain only capacitors recommended for motor power-factor improvement. Does this type of capacitor meet code requirements for surge-protective capacitor as stated above?—F.S.P.

**A.** Your question or questions raised are ones like many others in the code where I received a difference of opinion from engineers, as well as in reference books. However, in the first paragraph of your letter there was general agreement that if metallic raceways or conductors entered the hazardous area from the service equipment a wall would not be a governing factor in the installation. One insurance rating engineer stated that without more specific information he could not make a statement regarding the thickness of walls regardless of whether raceways or conductors entered the area. The purpose of lightning protection on electrical systems is to prevent surges of high voltages to travel along the lines and into electrical equipment whether it be located outdoors or inside buildings. Therefore, the

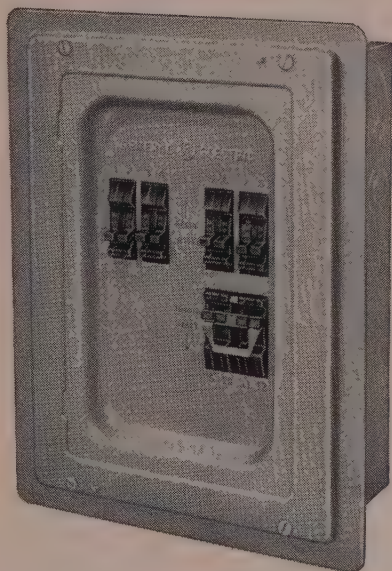


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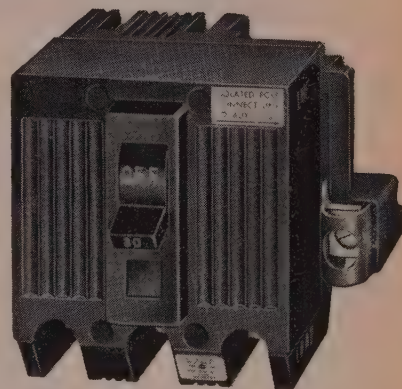
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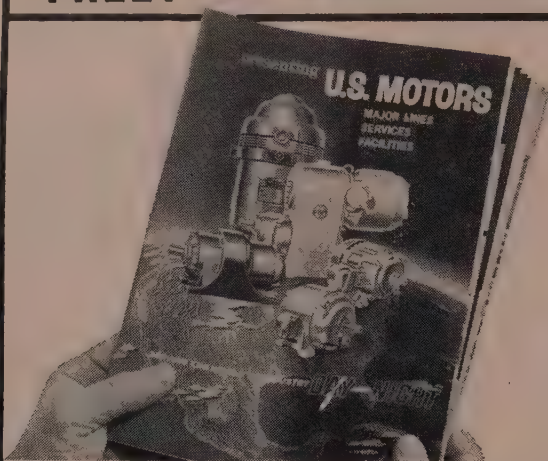
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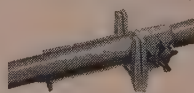
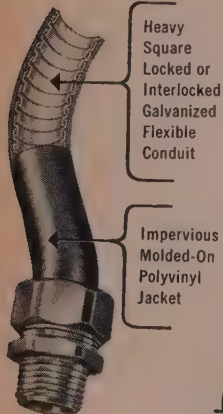
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answer to your first question would have to be resolved by the inspection authority in your area, because of the many variables involved.

In answer to the last question with reference to the type of capacitor, my information is this type capacitor is not the type required as it is stated surge-protective capacitors should be especially designed for this type of duty. In the Abbott and Sletka Handbook under Section 502-3 the following statement is made: "Complete information on methods of providing surge protection may be obtained from the Mill Mutual Fire Prevention Bureau, 400 W. Madison Street, Chicago, Ill."

As stated before, there are differences of opinion concerning this subject, so I would suggest that the insurance carrier involved be contacted on any installation requiring surge protection.—R.E.W.

## Fuses for Motor-Running Protection

**Q.** We have two industrial plants in my area that are using fusible equipment for motor-running protection, as well as branch-circuit protection. Both of these plants are using line starters less the overload relays; in essence they are only contactors. They are using dual-element fuses in the disconnect part of the combination line starter for both short-circuit protection and running protection for the motor. The questions that develop are these:

(1) Is this practice a violation of the code?

(2) If not, is the practice a sound one; and if not sound what are the reasons?

(3) Are there horsepower limitations for motors which would permit the use of dual-element fuses for both types of protection as outlined above?

(4) A bulletin issued by a fuse manufacturer states that such a practice can be safely carried out, providing the application is a normal one and the starter is not operated frequently. How often is "frequently?"—E.T.S.

**A.** In answer to Question No. 1, the practice is not a violation of the code, and reference is made to Sections 430-54 and 430-56.

In answer to Question No. 2, existing conditions and the installation itself would determine the answer to this question. Therefore,



definite statement cannot be made with reference to the general use of such equipment.

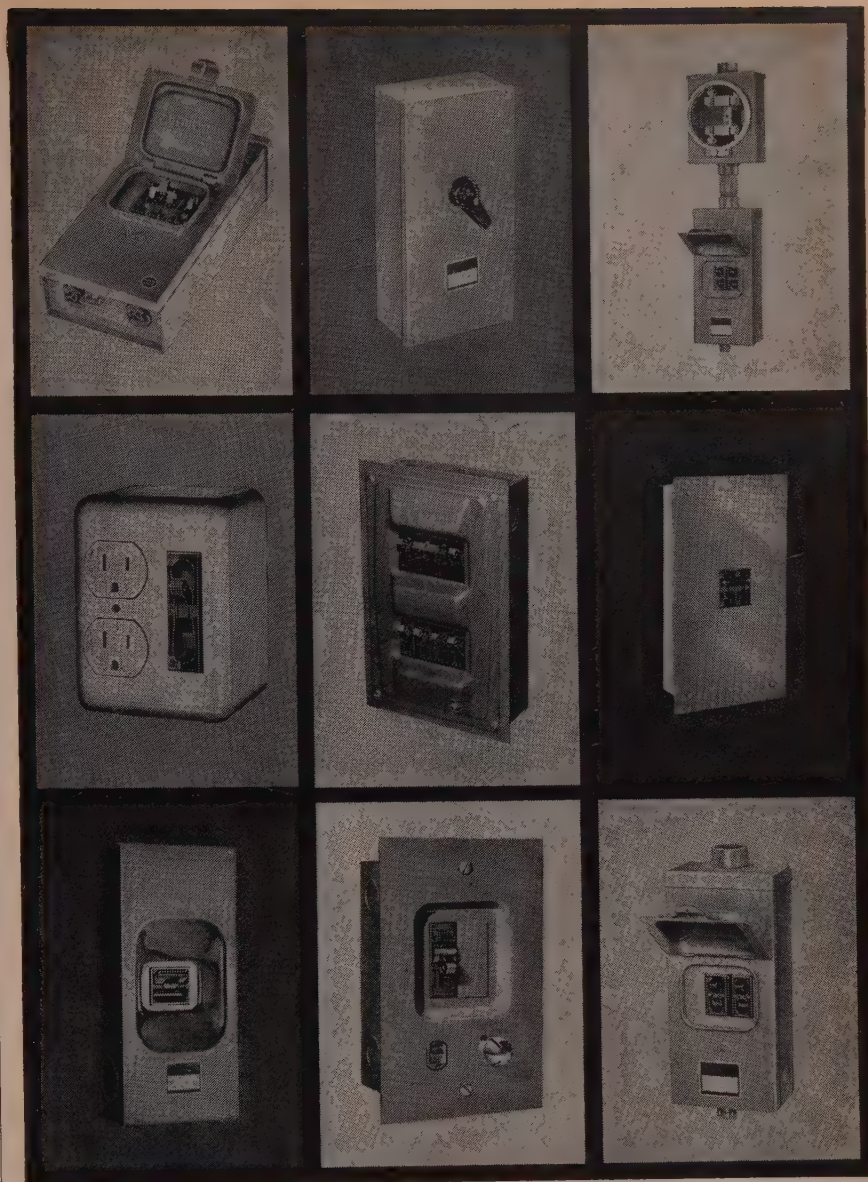
In answer to Question No. 3, there are limitations for which this type installation may be used, and I would certainly recommend that such limitations be followed. Most fusible switches are marked to indicate the maximum size time-delay fuses for given hp ratings.

Your fourth question concerns a statement made by a fuse manufacturer regarding the use of the word "frequently." My answer is that in a specific case be referred to the engineering department of the fuse manufacturer who published the booklet for their interpretation as to whether or not they would recommend the equipment to do the job satisfactorily under the given conditions. A general statement along this line would not be practical as it would only be a matter of personal opinion.

I fully realize that I have not given you direct answers to some of the questions raised. One reason is that many industrial plants have had experience with such equipment, and their engineers have found that what they are doing, regardless of technical rules, is in their best interest. In such cases where installations meet safety requirements, both from the shock and fire standpoint, and their record is good with the use of the equipment regardless of what is used, it is to this plant's advantage. On the other hand, another plant with a different operation may have an experience record opposite to the first one mentioned.—R.E.W.

## Accessibility of Disconnect Switches

**Q.** We have been questioned on the location of disconnect switches on some equipment in our plant. The code states disconnect switches must be accessible. Our equipment is fed through a 1000-amp busway located some 10 or 12 ft above the floor. Fusible disconnects are attached to the busway. Another disconnect is located between the busway and the equipment. The second disconnect is usually a combination starter device mounted or supported on flat irons attached to a stanchion. In order that clear walking space may be maintained under such an installation, switches are located approximately 90 in. from the floor. This means that small ladders or



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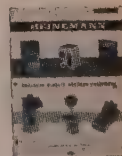
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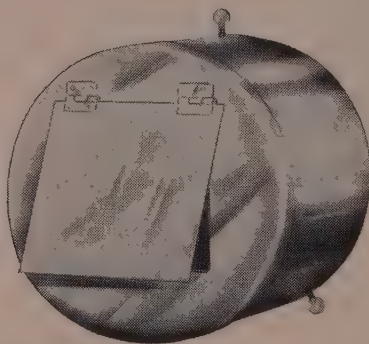
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Does this location meet code requirements of being accessible? G.R.N.

**A.** In Chapter 1 of the code the definition for accessible applied to equipment is as follows: "Admitting close approach because not guarded by locked doors, elevation or other effective means. (See 'Readily Accessible.')" Under "Readily Accessible" a note of explanation in the Abbott and Stetson National Electrical Code Handbook states: "The term readily accessible implies a need for performing promptly an indicated act, for example, to reach quickly a disconnecting switch or circuit-breaker without the use of ladders, chairs, etc. The installation of such switch or circuit-breaker at height above 7 ft from a standing level is not considered 'readily accessible.'"

The National Fire Protection Association at its 66th annual meeting held in Philadelphia, Pa., May 21-25, 1962, accepted and approved the report of the committee on "Machine Tool Electric Standards." This standard is NFPA No. 79. Under Chapter 120, Supply Circuit Disconnecting Means, of the standard the following requirements are recorded under Section 120-17 Operating Handle:

"(a) The operating handle of the disconnecting means shall be readily accessible.

"(b) The center of the grip of the operating handle of the disconnecting means, when in its highest position, shall not be more than 6 ft above the floor and it is recommended that it be at least 3 ft above the floor.

"(c) The operating handle shall be so arranged that it may be locked in the 'off' position.

"(d) When the control enclosure door is closed, the operating handle shall positively indicate whether the disconnecting means is in the open or closed position."

Some inspection authorities will consider and accept an extension from a switch handle that may be reached from the floor level as a means of disconnect for certain equipment. As an example, a short piece of rope attached to the switch handle on certain switches in your case could be used to disconnect the current supply from the device or machine. This would be a case of special permission, and not per NFPA No. 79.—R.E.W.



## LECTING MOTOR CONTROL SYSTEMS

[FROM PAGE 111]

rs as far as he was concerned, and he was quick to point out the reasons why he favored this particular system.

Nevertheless, just up the road, the second plant, the plant electrical people want nothing to do with control centers. They prefer combination starters, and they are equally quick to detail all of the reasons why combination starters are the very best for their particular problems.

Here we see influential people who probably have not analyzed their own feelings as to why they select a specific electrical system. They "just know."

We might mention here that this problem of personal prejudice is not limited to any one group of people. We know a number of consulting engineers who are specifying control centers and really do not know why. Perhaps it is easier for them to work on some of their drawings where they can simply draw in a box and label it "control center."

Our study took many months of effort and was directed toward analyzing every single detail of a specific job to gain a general impression of the initial cost, including material and labor, of comparable electrical systems. While we caution ourselves that this data cannot be lifted up completely and applied arbitrarily to any and all installations, our findings certainly do give us a general impression on the cost relationships which exist between control centers versus combination starters versus plain starters.

Perhaps even more important, however, we were reminded once again that the purchase of an electrical control system, like the purchase of anything else, is dependent on many factors of which cost is just one. Any one of the ten influencing factors listed above might well be the determining factor for a particular job. And each job merits a careful analysis.

Our hope is that all those associated with the selection of a motor control system will approach the problem objectively, with an open mind, so that the final selection will truly be best.

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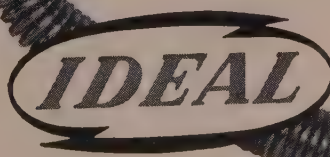
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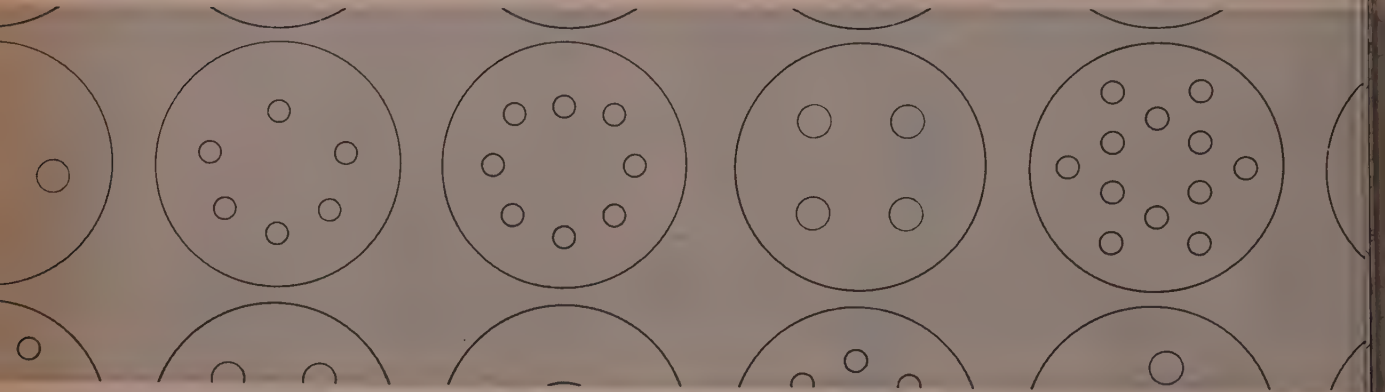
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PYLE-NATIONAL



## ALMCO Sets Sights on Market Development

The National Association of Lighting Maintenance Contractors (NALMCO) held its 1962 convention at the Edgewater Beach Hotel, Chicago, August 6-8. Focal point and general conference theme was the technique of promoting the need for lighting maintenance in the industrial and commercial fields and methods of channeling this tremendous market potential into definitive programmed maintenance, preferably the contract type.

Starting with a handful of men about eight years ago, NALMCO now has 125 members in 38 states and Canada (and even one in London, England). By coordinating the experience, technical know-how, and operating efficiency of its members, it has gone far in establishing standard procedures for effective programmed lighting maintenance.

President Eugene St. Jean, St. Jean Lighting Maintenance, West Springfield, Mass., reported definite association progress in service to members, growth and national recognition; noted that NALMCO members addressed IES and EEI meetings and were invited to contact utility personnel through a display booth at the 1962 EEI Sales Conference in Chicago. Herbert Mendelsohn, Sun Ray Lighting Corp., Kansas City, Mo., suggested that NALMCO develop a promo-

tional film that could be used at such meetings and by member contractors in their own localities. Malger Gray, Fluorescent Service Corp., Tampa, Fla., noted that NALMCO is considering development of a study course for training of lighting maintenance contractor personnel.

### National Accounts

Much of NALMCO's national recognition has come through its personal contact with headquarters executives of national merchandising chains (department stores, supermarkets, drug chains, oil companies, etc.). Since this program was initiated some two years ago, a large number of national firms have become interested in NALMCO services reported Melvin Galbraith, Approved Lighting Service, Cedar Rapids, Ia., chairman of NALMCO's National Accounts Committee. Many firms already have contracts with NALMCO members at the local level and others are considering it, delegates reported. Galbraith noted that one large chain recently issued an executive directive on group relamping in its stores, and the U.S. Postal Office department has developed a booklet outlining programmed lighting maintenance for its buildings.

Mr. Galbraith urged members to research their own operations to find less costly methods of maintaining lighting systems so they can show economic savings to highly cost-conscious prospects. With respect to national accounts, Galbraith revealed that NALMCO is: (1) attempting to learn home office policy on lighting maintenance and contract maintenance; (2) providing educational material to such firms; (3) urging them to adopt some standard type of lighting maintenance; (4) providing them with standard lighting maintenance specifications as a guide and basis on which their stores can call on local contractors for maintenance proposals.

Reports of a 3-year lamp life guarantee offered by some major lamp manufacturers caused considerable discussion at the sessions. NALMCO members view this with some concern since it upsets the 2-year relamping cycle and relevant maintenance contracts under which many of them are now operating. Chances are this will generate con-



**FOUNDERS OF** the National Association of Lighting Maintenance Contractors some eight years ago included these charter members at the recent NALMCO convention in Chicago: (L to R) Herbert Mendelsohn, Sun Ray Lighting Corp., Kansas City, Mo.; Edward I. Creed, C & S Lighting Maintenance Co., Cleveland, Ohio; and K. L. Purington, Lighting Sales & Service Co., Davenport, Iowa.

siderable study and research by those immediately affected.

### Utility Cooperation

Should utilities be interested in NALMCO member services? Do the utilities have a stake in programmed lighting maintenance? NALMCO's answer is a definite "yes." In fact, NALMCO—through a printed folder distributed at the EEI Sales convention in Chicago—has alerted the utility industry to the fact that it is losing \$180 million annually in kwhr sales because 10% of the lamps (based on a national survey) in industrial and commercial buildings throughout the country are not operating because of burnout or defective components. The message is that these lamps would be burning, and using kwhrs, if those customers had programmed lighting maintenance and group relamping.

That utilities are interested and are cooperating was evidenced in a panel discussion. Members of the panel included: W. W. Kelly, Jr., Fluorescent Maintenance Service, Inc., Jackson, Miss.; Eugene St. Jean, St. Jean Lighting Maintenance, West Springfield, Mass.; Malger Gray, Fluorescent Service Corp., Tampa, Fla.; and Edward Creed, C & S Lighting Maintenance Co., Cleveland, Ohio. These contractors report highly successful utility cooperation; even do contract



**THE FUTURE** of contract lighting maintenance with national chains is subject of this NALMCO huddle at recent Chicago convention. Expressing views are (L to R): Melvin Galbraith, Approved Lighting Service, Cedar Rapids, Ia.; Fred Astor, Astor Electric Service, Inc., Miami Beach, Fla.; and Richard Pieper, Pieper Electric Co., Milwaukee, Wis.





## Pretty receptionist flips *Sno-Melter* switch; clears snow from shipping docks, truck ramps, walks!

Shall we hold a wake for the old snow shovel? The modern snow removal system—Sno-Melter—operates at the flip of an electric switch. Operates economically, too, because warm-up and melt-off time are far faster than with any heated liquid system.

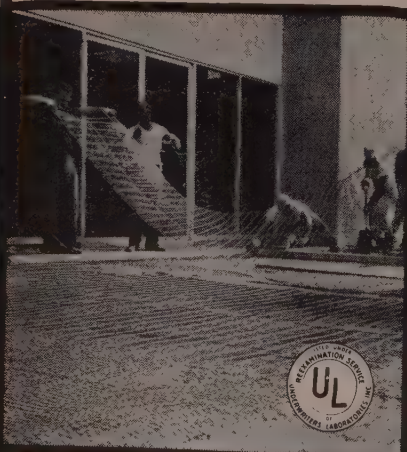
Constructive way to use spare electrical capacity which is freed when air conditioning goes off!

Installation? Compare the old method of laying a maze of circulating pipes, with a modern Sno-Melter. This system incorporates pre-spaced, anchored resistance wire in mats which roll out like rugs as concrete is poured.

Standard sizes cover 4 to 90 square feet—dissipate either 42 or 60 watts of uniformly even heat per. Other sizes on special order.

Now, firms whose trucks used to spin their wheels every winter can start them out on solid ground. A company's customers will always find a clear path to its dock. And maintenance crews, with no more snow to shovel, nor ice to chop, can be more productive.

Better get the facts on Sno-Melter on file; you're going to want to recommend it. Write for detailed 4-page folder.



# EASY-HEAT INC.

"Electric Snow Removal Equipment"  
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**NALMCO STUDY** course chairman, Malger Gray, Fluorescent Service Corp., Tampa, Fla., tells members at recent Chicago convention that progress is being made on development of a study course for training lighting maintenance personnel.

maintenance for their local utilities.

Additional floor discussion revealed the following ways in which utilities help contractors: one sends a contractor promotional letter to 10,000 of its commercial and industrial customers; another turns over lamp outage reports to the contractor; several turn leads over to contractors; another recommends systematic maintenance with every lighting layout it makes. One NALMCO member reported closing 20 to 30 contracts on utility leads.

Cooperation like this doesn't come easy, warned Pat Bordelon, Salem Fluorescent Maintenance Service, New Orleans, La., chairman of NALMCO's Utility Committee. You've got to sell them on systematic lighting maintenance and show them how NALMCO member's services can add kw/hr sales, he noted.

General consensus was that the best utility contacts were personnel of the lighting sales department.

Earlier this year, NALMCO established a Utility Member grade. Already two companies have become members. Reports indicate this list will grow.

## Promotion and Sales

Market development through direct mail and personal sales was analyzed by experts in the respective fields.

Dick Lundgren, General Electric Co., Cleveland, Ohio, defined a direct mail piece as a "sales call in print"; noted that, if handled properly, it can be an effective door opener to a personal call. For those using or considering direct mail programs, Lundgren had these suggestions: survey and select your immediate market area; set an objective; carefully write and direct your copy to this group; remember that 85% of

a person's knowledge is gained through his eyes; emphasize lighting maintenance can do for a prospect and highlight the service of your company. Develop a mailing list (utility lists are excellent), he continued, and send material to a specific person in a firm—if possible. Be prompt in follow-up inquiries. Instead of measuring the success of a direct mail promotion in a percentage return of inquiries, base it on number of orders resulting from it, Lundgren concluded.

When making personal calls, use a light meter to show the prospect just how much lighting he is getting and leave a copy of the Illumination Engineering Bulletin of Recommended Light Levels with him, suggested Charles Zersen, managing director, Chicago Lighting Institute. Tell the prospect what he can gain from lighting maintenance and how you can help him. Create an awareness of better lighting to help you sell your services, Zersen advocated.

Every business should have a sales force with individuals concentrating on sales techniques and problems, stated R. L. Ringer, sales consultant, Los Angeles, Calif. Before a prospect can understand and appreciate a NALMCO member service, he has to be sold on the idea and advantages of a lighting maintenance program. Being convinced that selling is basically a mental attitude, Ringer prefers the one-track mind that cannot be diverted from the prime goal of selling. With regard to lighting maintenance sales personnel, Mr. Ringer had these recommendations: try to get men who think in terms of duties and responsibilities and not just self-advancement; carefully train them in the basics of selling techniques for your specific field; anticipate sales resistance arguments on the part of prospects and give your men answers to counteract such points. Although he indicated preference for the commission type compensation, Ringer acknowledged that in today's security-conscious environment a salary or salary plus commission is necessary to attract sales personnel.

## Technical Forums

Immediately after adjournment of general sessions, delegates attended a series of concurrent forums on related technical problems. Among subjects discussed were labor man-hours, outdoor floodlighting maintenance; estimating techniques, overhead, selling tools, bal-

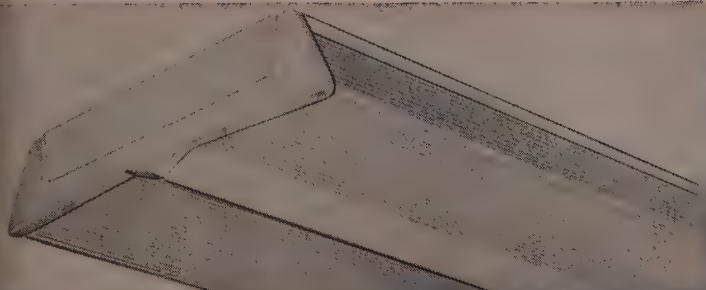




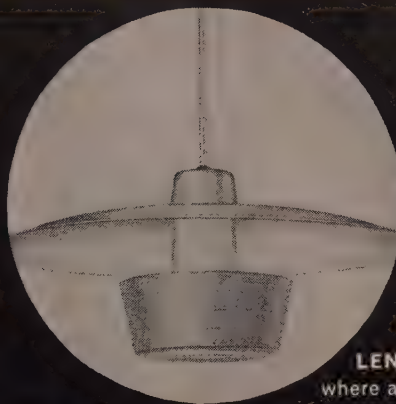
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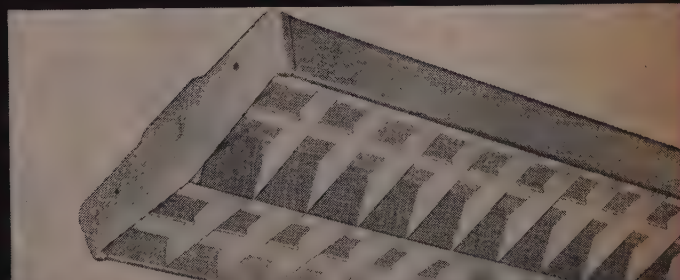
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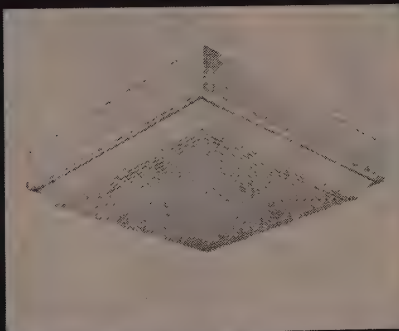
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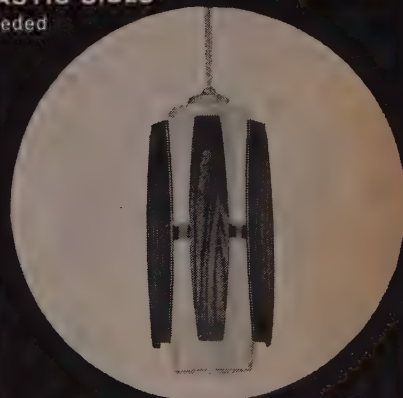
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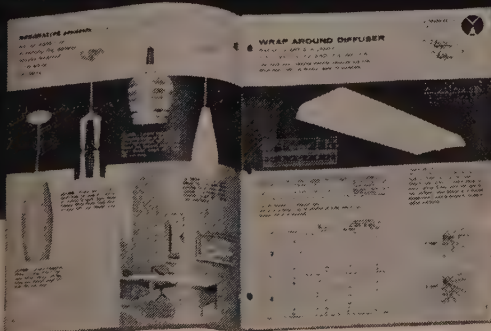
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**GENERAL  ELECTRIC**



**17TH ANNUAL** All-Industry Convention, sponsored by Carolinas Chapter, NALMCO, was held July 25-27 at Myrtle Beach, S. C. Attending were: J. O. Howard, Howard Green Electric Co., Raleigh, N. C.; T. L. Watson, Jr., Watson Electrical Construction Co., Wilson, N. C.; R. K. Robinson, Robinson Electric Co., Charlotte, N. C.; and Bryant, F. E. Robinson Co., Inc., Charlotte, N. C.

last problems, washing techniques, lamp life and new products, and sales training.

Opinions and conclusions expressed at these sessions included the following:

The most practical labor unit division for lighting maintenance is 100 units to the hour. Multipliers should be applied to normal units to take into account job factors and manpower efficiency.

A successful lighting maintenance operation requires good labor relationships, adequate wage scale and proper briefing on each job.

Use of proper, safe equipment, mechanized aids, adequate tools, and well-stocked trucks boosts operating efficiency. Careful routing and crew shifting also help. Some contractors use a 90-day cycle for crew shifts.

Uniformed personnel is good company promotion.

There is room for improvement in detergents, particularly a non-foaming type for mechanical washers.

Figuring lighting maintenance on a per-lamp basis is hazardous. Fixture mounting and ballast age should be carefully checked.

Electrically heated buildings with ceiling insulation directly over concealed fixtures need careful checking because trapped heat can substantially reduce ballast life.

Moderating the various forum sessions were the following NALMCO members: W. C. Abrams, Eveready Electric Co., San Francisco, Calif.; Herbert Kohn, Gro-Ko Sales Co., St. Paul, Minn.; Eugene St. Jean, St. Jean Lighting Maintenance,

West Springfield, Mass.; Ward I. Creed, C & S Lighting Maintenance Co., Cleveland, Ohio; Robert E. Watson, Fluorescent Maintenance Co., Denver, Colorado; Leon Mendelsohn, Steel City Fluorescent Maintenance, Inc., Chicago, Ill., and Bert Osterman, Flood-It Service, Inc., Los Angeles, Calif. Introduced at the conference were these three recently elected (by mail ballot) NALMCO regional vice presidents: Eastern Region—C. E. Hessler, The Eastern Sales Engineering Co., Baltimore, Md.; Central Region—E. I. Creed, C & S Lighting Maintenance Co., Cleveland, Ohio; Midwest Region—R. Watson, Fluorescent Maintenance Co., Denver, Colo.

Chairman of the local arrangements convention committee was Jerome Gimbel, Sun-Ray Fluorescent Co., Chicago. Lin Best, Best Fluorescent Maintenance Co., Temple City, Calif., headed the convention program committee.

## Council to Develop Electrical Standards

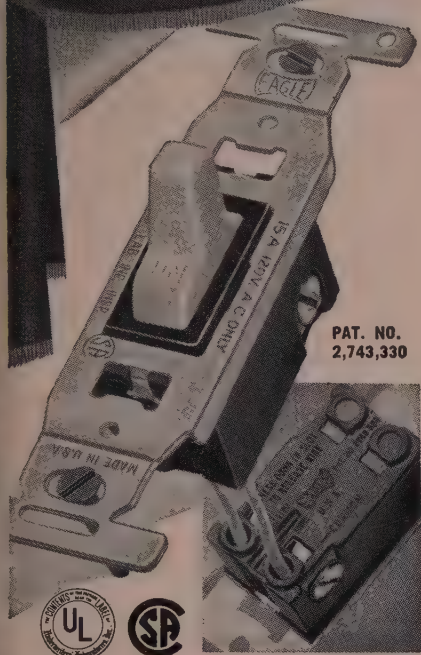
Representatives of major automobile manufacturers and two national trade associations met on July 26 in Detroit, Mich., to form the Industrial Electrical Equipment Council for the purpose of developing electrical standards for industrial equipment.

Present at the meeting were delegations from American Motor Corporation, Chrysler Corporation, Ford Motor Company, General Motors Corporation, National Ma-



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"PERFECTION IS NOT AN ACCIDENT"

chine Tool Builders' Association and the National Electrical Manufacturers Association. The Council thus constitutes a joint committee of users and suppliers of equipment to which the newly developed and up-dated standards will apply.

The new Council supersedes the former Joint Industry Conference which has been largely inactive in recent years, although automobile manufacturers and other users have continued to utilize modifications of JIC standards in the absence of later data. One of the major tasks confronting the new group will be to reconcile and consolidate existing electrical standards for machine tools and other industrial equipment, to revise those which are out of date, and to prepare new standards where none exist.

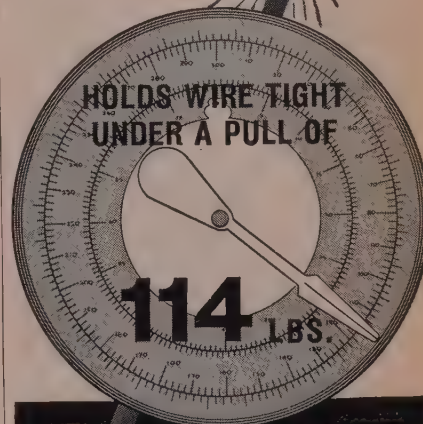
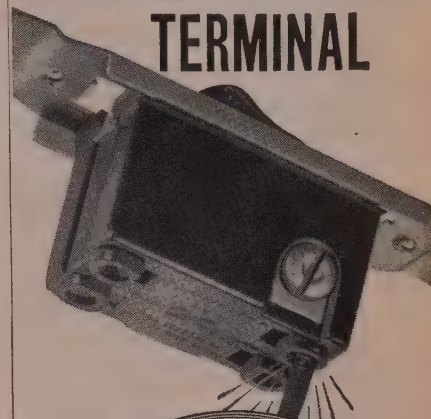
The National Electrical Manufacturers Association was authorized to coordinate the joint activity; to provide the chairmanship of the Council's Executive Committee and to supply secretarial assistance. The newly developed standards, however, will not be known as NEMA standards, but will represent a combined effort of all interested parties. The ultimate objective will be to have all such standards processed as American Standards through the American Standards Association.

Although the new activity is directed initially at providing the automobile industry with an opportunity of clarifying and unifying its varying electrical requirements for machine tools and industrial equipment, the Council recognizes that its publications may apply to many other industries as well. For that reason it is contemplated that the presently organized Executive Committee will in the future include representatives from other industries as the need arises for broadening the base of present operations.

The Executive Committee will constitute the Council's policy making body. Under it will be a Technical Committee which will be charged with coordinating work of various sub-committees and in preparing general electrical standards for industrial equipment. At the outset the Council will limit its activities to electrical standards for machine tools, with two sub-committees presently being set up for that purpose—one dealing with machine tools for mass production purposes, and the other concerned with general purpose machine tools. Additional sub-committees will be



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formed later, including representation from those industries primarily concerned, such as manufacturers of welders, furnaces and other equipment.

L. D. Price, manager of the NEMA Engineering and Safety Regulations Department, was named temporary chairman of the Council, and R. W. Shaul, member of the same NEMA Department, was appointed Secretary.

## EASA News

Established independent small businesses can go broke as easily as new ventures, EASA International President Ben J. Horton warned members recently. He is vice-president of The Atkinson Armature Works, Pittsburg, Kansas.

Referring to Dun & Bradstreet's report on business failures, Mr. Horton said: "There seem to be as many ways of going broke as there are of making a profit." Furthermore, the Kansas industrialist warned: "If we cannot show a profit that will allow shop improvements, then we are in a sense 'going broke.'"

Old businesses are not always in sound conditions, Mr. Horton said. Some become only shells of their former selves, others suffer from complacency, and some acquire new management that does not always rise to new challenges.

Independent electrical service firms were advised by Mr. Horton to be alert to economic and market conditions that might cause them to wind up the year without a profit.

Another leading electrical apparatus service company manager, William R. Lugar, Kiemle Co., Toledo, Ohio urged association members to take fuller advantage of EASA memberships. "Since 1954 some one from our top management has attended each EASA convention," he stated recently. Sometimes as many as four or five attended.

"They have been able to bring back from each convention at least one idea which made the time and expense of attending worthwhile. There were ideas for short and long-range modernization of plant facilities; for reduction of handling costs; for a smoother flow of work to give faster service."

Bringing customers into one's shop is an effective means of sales promotion, Mr. Lugar has found. "Generally the customer is very surprised to learn that a motor re-



**EASA PAST-PRESIDENTS** Joseph H. Previty, Penn Electric Motor Co., Philadelphia, and Selden F. High, The Sullivan Electric Co., Cincinnati, in a post-session huddle at the 29th EASA Convention in Chicago.

pair shop can be large, efficient and clean," he asserted.

"Big D in '63" was the theme of a meeting of Dallas shop operators who convened with EASA officials and other members of the association's convention committee on August 11 at the Statler-Hilton in the Texas city to formulate plans for the 30th Annual Convention next June 9-12.

The annual conference of the Southeastern Chapter of EASA will be held October 25-27 in Jacksonville, Fla. Lester Belcher, Jacksonville Armature & Motor Works, and Joe Wright, Turner Electric Works, are co-chairmen. The organization will also meet in Raleigh, N. C., March 29-30, for the annual Technical Forum.

Members of EASA's chapters in the Pacific Northwest will convene in Seattle, Wash., on October 5-6 at Hotel New Washington Doric for the annual Pacific Northwest Conference. Earl Brooks, United Electric Motors, Seattle, is handling arrangements.

Three Puerto Rico electrical apparatus service firms and one from Jamaica have joined EASA's Southeastern Chapter, it has been announced by Roger Wilson, president. Nieves Electric Service, Ponce; Stateside Service, Santruce; and Atlantic Rewinders Co., San Juan, are the new members from the Commonwealth; while R. A. Silvero, Ltd., Kingston, is the member from the newest independent nation in the Western Hemisphere.

Members of Greater St. Louis Chapter of EASA heard International President Ben J. Horton



...speak at a meeting in Edwardsville, Ill., at the Edwardsville Gun Club on July 26. The members also heard August A. Baechle, EASA executive vice-president, and Jack Langford, safety engineer, Monsanto Chemical Co. Arrangements were handled by Elbert Niebruegge, Hopcroft Electric & Machine Shop, Inc., Edwardsville.

• • • • •

Don Osenbaugh, who recently joined the Roy M. Butcher Electric Co., San Jose, Calif., after a successful career at the J. L. Hughes Co., Columbus, Ohio, has been named chairman of the West Coast Conference of EASA, to be held October 6 at Del Webb's Town House, San Francisco.

• • • • •

The Jones Electric Machinery Co., Topeka, Kansas, an EASA member firm, has been appointed a distributor for Allis-Chalmers motors and control equipment, according to E. A. Jones, owner of the 32-year-old firm.

• • • • •

Utility Transformer and Equipment Co., Baraboo, Wis., an associated firm of Chicago Electric Co., Chicago, Ill., recently announced the appointment of 18 new manufacturers' agents, according to Glenn F. Glave, president.

• • • • •

J. H. Martin, executive vice-president, and Paul K. Wolfram, sales manager of Inmanco, Inc., an EASA associate member firm, recently celebrated their 25th anniversaries with the company.

• • • • •

Approval of Denver, Colo., as the site for the 1965 EASA Convention, was made by the association's board of directors at their spring meeting. Other conventions are scheduled to be held in Dallas, in 1963, and in New York City in 1964.



**CORRIDOR CONFAB** at EASA Convention in Chicago finds Paul V. Bush, Lubbock Electric Co., Lubbock, Texas; and Joe M. Wright, Turner Electric Works, Jacksonville, Fla., discussing session agenda.

## DATES AHEAD

**American Home Lighting Fixtures Month**—National promotion, September 1-30.

**International Association of Electrical Inspectors**—Chapter Meetings—**Eastern Section**, Mt. Washington Hotel, Breton Woods, N. H., September 10-12; **Western Section**, Morrison Hotel, Chicago, Ill., September 17-19; **Northwestern Section**, Tyee Motel, Olympia, Wash., September 24-25; **Southwestern Section**, Hobergs, Calif., October 1-3; **Southern Section**, Tutwiler Hotel, Birmingham, Ala., October 15-17; **Canadian Section**, Queen Elizabeth Hotel, Montreal, Can., November 1-2.

**Associated Independent Electrical Contractors of America**—Convention, Blackstone Hotel, Ft. Worth, Texas, September 14-15.

**Canadian Electrical Mfrs. Assn.**—Annual meeting, Sheraton-Brock Hotel, Niagara Falls, Ont., October 3-5.

**International Assn. of Electrical Leagues**—27th annual conference, Sheraton-Chicago, Chicago, Ill., October 3-5.

**National Electronics Conference**—McCormick Place, Chicago, Ill., October 8-10.

**National Electrical Contractors Assn.**—Minneapolis Auditorium, Minneapolis, Minn., October 9-13.

**Rocky Mountain Electrical League**—Fall convention, The Broadmoor, Colorado Springs, Colo., October 14-18.

**Materials Handling in Canada Exposition**—Automotive Bldg., Exhibition Park, Toronto, Can., October 15-18.

**Florida Association of Electrical Contractors**—Annual conference (no trade show), Castaway's Motel, Daytona Beach, Fla., October 18-20.

**Electrical Manufacturers Trade Show**—Indiana State Fair Grounds, Indianapolis, Ind., October 23-25.

**National Electrical Manufacturers Assn.**—Annual meeting, Shoreham Hotel, Washington, D. C., week of November 12.

**Electrical & Home Appliance Show**—Balboa Park, San Diego, Calif., November 23-28.

**Building Research Institute**—Fall conference, Mayflower Hotel, Washington, D. C., November 27-29.

**Electrical Engineering Exposition**—Sponsored by AIEE, Coliseum, New York, N. Y., January 28-31, 1963.

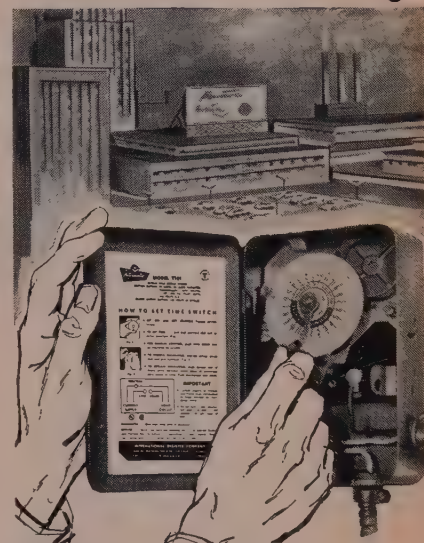
**16th International Heating & Air Conditioning Exposition**—Coliseum, New York, N. Y., February 11-14.

**Associated General Contractors of America**—44th annual convention, Americana Hotel, New York, N. Y., March 4-7.

**4th Southeastern Plant Engineering and Maintenance Exposition**—Merchandise Mart, Charlotte, N. C., March 5-7.

**WHEN PERFORMANCE REALLY COUNTS! control it**

*"Intermatically"*



Electrical contractors know and rely on rugged, dependable, T-Rated Intermatic switches. Built to perform continually under the most extreme conditions, Intermatic provides the reliability and accuracy necessary to meet the toughest, most demanding requirements—and you can depend on them. Fast, easy installation, fewer customer callbacks save you time and money. Engineered and built to give you more for your money, Intermatic switches build your reputation with customer satisfaction. Reliable quality—that's Intermatic!

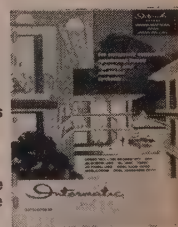
**special Intermatic® features!**

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**OVER 100 MODELS TO CHOOSE FROM!**

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- Up to 55 amps
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- Astronomic Dial Switches
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☐ Complete catalog of all products. Bulletin 92-BB

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COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

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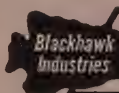
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**BLACKHAWK INDUSTRIES**

DUBUQUE, IOWA

Where the new ideas come from



## Among the Manufacturers

### Headquarters Announcements

**Master Vibrator Co.**, Dayton, Ohio, has been renamed **Master Consolidated Inc.**

**Sunbeam Lighting Co.**, Los Angeles, Calif., has acquired the **Interior Systems, Inc.**, Los Angeles. The new firm will be operated as a division of Sunbeam and will be known as **Sunbeam Interior Systems**.

**Oak Mfg. Co.**, Crystal Lake, Ill., has announced the completion of the acquisition of **Hart Mfg. Co.**, Hartford, Conn., and the election of **Robert T. McTigue** as Hart president.

**General Electric Co.**, Schenectady, N. Y.—**Harold C. Robertson**, manager of marketing, Ballast Dept., Danville, Ill.

**Bunting Brass and Bronze Co.**, Toledo, Ohio—**Joseph M. Williams**, director of research and development.

**Continental Copper & Steel Industries, Inc.**, New York, N. Y.—**Walter H. Knorr**, treasurer, has also been elected a vice president.

**General Electric Co.**, Cleveland, Ohio—**Ralph E. Crockett**, manager of Commercial and Industrial Sales at Nela Park; Large Lamp Dept.

**Allis-Chalmers Mfg. Co.**, Milwaukee, Wis.—**W. C. Sealey**, manager of engineering—product systems, Transformer Dept.; **L. C. Aicher**, system engineer, Electrical Transmission and Distribution Div.; **W. J. Klein**, director of marketing services and public relations; **Charles W. Parker, Jr.**, manager of marketing services; **Alfred B. Leech**, public relations manager—new Marketing Services and Public Relations Div.

**General Electric Co.**, Waterford, N. Y.—**Donald V. Brown**, manager of electrical market development unit; **Davidson Clark**, manager of fluid market development unit; **Silicone Products Dept.**

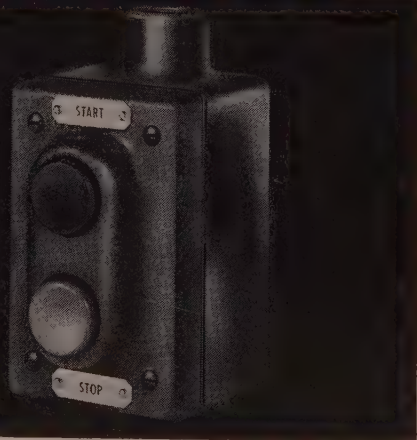
**Minnesota Mining & Mfg. Co.**, St. Paul, Minn.—**Roy J. Gavin**, divisional vice president, Irvington and MICO Divisions.

**Westinghouse Electric Corp.**, Pittsburgh, Pa.—**Thomas J. Murrin**, engineering manager, Motor and Gearing Div., Buffalo, N. Y.

**Federal Pacific Electric Co.**, Newark, N. J.—**Irvin A. Kleinman**, marketing manager, electric heating products.

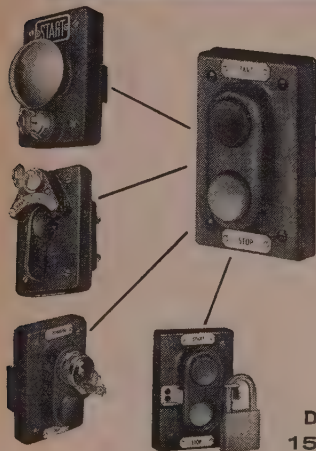
ON  
THE  
BUTTON  
WITH SAVINGS!

REES



## ALL MODELS OF HEAVY-DUTY OIL-TIGHT QUALITY CONTROLS *below heavy-duty prices!*

Rugged Rees heavy-duty control buttons are designed to meet every application. These durable units are available in all types of trouble-free models for conduit mounting. Send for complete details in the new Rees Section 1 catalog!



**MACKWORTH G. REES**

Division of **Avis INDUSTRIAL CORPORATION**  
1575 E. Forest Ave. • Detroit 7, Michigan



**Anaconda Wire and Cable Co.,** Marion, Ind.—David A. McCarthy, manager of portable cable sales.

**Stanley Works,** New Britain, Conn.—Donald W. Davis, executive vice president.

**Standard Kollsman Industries, Inc.,** Melrose Park, Ill.—Joseph P. Tumminaro, vice president of manufacturing.

**Youngstown Sheet and Tube Co.,** Youngstown, Ohio—Harold Hoekelman, general manager of steel operation.

**Electric Storage Battery Co.,** Philadelphia, Pa.—John R. Smyth, director of engineering, Exide Industrial Div.

**Kellems Co.,** Stonington, Conn.—Robert W. Dixon, vice president and general manager.

**Sylvania Electric Products Inc.,** Salem, Mass.—Rolf M. Moller, product manager for incandescent sales, Lighting Products Div.

**Jomac Inc.,** Philadelphia, Pa.—Richard C. Hughes, Jr., sales manager, Protective Clothing Div.

**Minneapolis-Honeywell Regulator Co.,** Minneapolis, Minn.—Robert J. Ruff, manager of advertising and sales promotion for temperature control segment.

## Regional Appointments

### NEW ENGLAND

**Christopher York Lighting, Inc.:** Jack Meany, Meaney, O'Connell, Millerick, Inc., Cambridge, Mass., manufacturer's representative covering Massachusetts, Connecticut, Vermont, Rhode Island, New Hampshire and Maine.

**Jasper Blackburn Corp.:** Arthur J. Cayon, Winthrop, Mass., manufacturer's representative covering Maine, New Hampshire, Vermont, Rhode Island and eastern Massachusetts.

**General Electric Co.:** Donald W. Marshall, sales representative of Silicone Products Dept. located at Boston, Mass.

**Line Material Industries, McGraw-Edison Co.:** Robert M. Hannan, lighting engineer covering New England region with headquarters in Revere, Mass.

### MIDDLE ATLANTIC

**Christopher York Lighting, Inc.:** Nate Schwinger, Broomall, Pa., manufacturer's representative covering eastern Pennsylvania, Maryland, Delaware, Virginia, Washington, D. C., and Camden, N. J.

**Jasper Blackburn Corp.:** Donahue & Smith Co., Philadelphia, manufacturer's representative in

eastern Pennsylvania and southern New Jersey.

**Safety Tower Ladder Div., Air Space Devices:** Dunbar A. Eberts, representative covering New York and northern New Jersey.

**General Electric Co.:** Larry D. Stoddard, representative in new sales office, Buffalo, N. Y., Silicone Products Dept.

### SOUTH ATLANTIC

**Fanner Mfg. Co.:** Charles R. Lee & Associates, Inc., Miami, sales representative for southern portion of Florida; Van & Smith Co., Inc., Tampa and Jacksonville, sales representative for central and northern Florida; Electrical Products Div.

**Dayco Corp.:** James Gregory, Jr., district manager with headquarters in Gastonia, N. C., Industrial Sales Dept., Rubber Products Div.

**Safety Tower Ladder Div., Air Space Devices:** Car-Mad Safety Equipment, Inc., Florida, representative.

**General Electric Co.:** Joseph B. Foley, manager, southern sales region, with headquarters in Atlanta, Ga.; Robert R. Dable, manager, Virginia sales district, with headquarters at Richmond; Large Lamp Dept.

**Trade Service Publications, Inc.:** Harold C. Horne, Charlotte, N. C., representative in the southeastern states.

### EAST CENTRAL

**Safety Tower Ladder Div., Air Space Devices:** O. M. Bercaw & Associates of Illinois, representative; Cable-Hight Co. of Ohio, representative; Gardner Scott Corp. of Michigan, representative.

**Dayco Corp.:** Alan Larsen and Edward Collins, district managers headquartered in Chicago; Industrial Sales Dept., Rubber Products Div.

**Pfaff & Kendall:** Gene Goodman, representative in Memphis, Tenn.

**Thomas & Betts Co.:** Edward F. Kramer, district manager in Cleveland, Ohio.

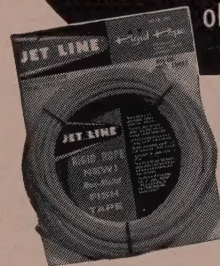
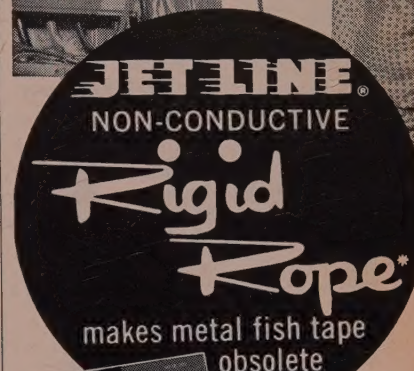
**General Electric Co.:** Robert J. Schulte, manager of Chicago sales district; Large Lamp Dept.

**Okonite Co.:** P. B. Lavelle, district manager of new Indianapolis, Ind., office.

**Kollsman Instrument Corp.:** J. A. Jancar Co., Dearborn, sales representative for Michigan except upper Peninsula; Richardson-Allen Div.

**Hyster Co.:** William G. Holiday,

# For "fishing" conduit



NOW — with RIGID ROPE — fish any 1/2", 3/4", 1" conduit faster, safer, for less cost!

- **Greater rigidity** — tightly braided jacket over improved core. Non-conductor!
- **Strong** — withstands one or two man pull.
- **Affords excellent grip** — never cuts even when wrapped around hand.
- **Lightweight** — 14 oz. per 50 ft. Available in 50' and 100' lengths.

RIGID ROPE costs less than any metal tape designed for use in all types of conduit. (Polyethylene "Guide Sleeve" for outlet boxes included.)

\* Patent Pending



New improved core



New metal eye



Non-conductive loop  
Connect wire at either end!

For full information on RIGID ROPE, and the complete Jet Line Method of wiring conduits, ask your distributor or write

**JET LINE PRODUCTS, INC.**

305 Foster Ave.  
Charlotte 3, N. C.

5916



# Midwest WEATHERPROOF POWER OUTLETS

FOR FARMS, RANCHES,  
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**U-L APPROVED  
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There are over 150  
Midwest Power  
Outlets in Circuit  
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from.

All major Midwest  
Power Outlet  
Models are U-L  
Approved.

**FAST . . . LOW COST  
INSTALLATION!**

All panels are  
pewired. Each  
power outlet has  
solderless terminals  
for fast  
installation.

A hub in the top  
and K.O.'s in the  
bottom facilitate  
overhead and  
underground  
wiring.

**COMPLETELY WEATHER-  
PROOF—TAMPERPROOF**

Covers close  
completely while in  
use and can be  
padlocked to elimi-  
nate tampering.

Midwest Power  
Outlets are con-  
structed of heavy  
gauge electro-gal-  
vanized steel with a  
gray baked enamel  
finish.

SEE YOUR LOCAL  
ELECTRICAL  
DISTRIBUTOR  
OR WRITE—

**Midwest  
ELECTRIC PRODUCTS, INC.**  
DEPT. 1515—MANKATO, MINNESOTA

manager of Danville, Ill., plant.  
Youngstown Sheet and Tube  
Co.: James W. Kirkpatrick, man-  
ager of Chicago district.

## WEST-CENTRAL

Allis-Chalmers Mfg. Co.: Tiney's  
Electric Co., Lincoln, Neb., agency  
in portions of Nebraska and Kan-  
sas.

General Electric Co.: Robert J.  
Lee, manager of Mississippi Valley  
sales district in St. Louis; Large  
Lamp Dept.

Harvey Aluminum: Stein & Jen-  
sen Sales Co., St. Paul, sales rep-  
resentative covering Minnesota,  
North and South Dakota and  
northern Wisconsin.

Ilg Electric Ventilating Co.:  
Robert D. Robinson, sales rep-  
resentative in the western half of  
Oklahoma with headquarters in  
Oklahoma City sales office.

Dayco Corp.: Herbert Simpson,  
district manager headquartered in  
New Orleans; Industrial Sales  
Dept., Rubber Products Div.

Frank Adam Electric Co.: Semco  
Sales Co., Houston, sales rep-  
resentative for southern half of  
Texas.

## WEST

General Electric Co.: Lysander  
T. Ashlock, sales representative  
with offices in Downey, Calif., Sili-  
cone Products Dept.

Plymouth Rubber Co., Inc.: W. C.  
Osborn, Phoenix, tape representa-  
tive in Arizona; Strong & Humph-  
rey, Denver, tape representative in  
New Mexico, Colorado, Wyoming  
and southern Montana.

Sola Electric Co.: Robert M.  
Mayers, district sales engineer for  
western sales district office in Los  
Angeles.

I-T-E Circuit Breaker Co.: Fred  
A. Thornton, district manager for  
new sales office in Salt Lake City,  
Utah.

Anaconda Wire and Cable Co.:  
Norman A. Lorimer, manager of  
sales, Orange, Calif., plant.

Christopher York Lighting, Inc.:  
John Reynold, Reyco Sales Agency,  
Salt Lake City, manufacturer's  
representative for Utah and Idaho.

Safety Tower Ladder Div., Air  
Space Devices: Robert C. Brinkley,  
representative covering Washing-  
ton for production metals.

Okonite Co.: Thomas A. Kom-  
mers, manager of Portland, Ore-  
gon office.

Harvey Aluminum: Electrical  
Agencies, Inc., Denver, sales rep-  
resentative for Colorado and New  
Mexico.

TESTS PROVE:  
**10% more slip**

with

**Y-ER EAS**

Wire Pulling Lubricant  
For Lead, Rubber, Braid or  
Synthetic Covered Cables

**There is only  
one Y-ER EAS**

**Don't accept substitutes.  
The extra slip means extra  
savings on every job.**

- Creamy, non-corrosive.  
Never greasy or messy.
- Prevents sticking or setting.  
Extra slip for saddles and  
turns.
- Does not run back on cables.
- Never harmful to hands, cloth-  
ing, cables or conduit.

**NEW!  
ALUM-N-EAS**  
Thread lubricant  
stops binding of  
aluminum conduit  
connections!

Write for  
descriptive  
literature



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**Hundreds of  
helps for the  
practical  
electrician**

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Fast, accurate, on-the-job assistance in solv-  
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REMOTE ALARM AND  
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transmits 30 on-off alarms  
or control over single  
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\$990 COMPLETE

**TELEPLEX**  
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(Classified Advertising)

EMPLOYMENT BUSINESS  
EQUIPMENT, — USED OR RESALE  
**OPPORTUNITIES**

### DISPLAYED RATE

EQUIPMENT & BUSINESS OPPORTUNITY  
Advertising \$24.35 per inch.

EMPLOYMENT OPPORTUNITIES—\$32.60  
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An advertising inch is measured 7/8" verti-  
cally on one column, 3 columns—30  
inches—to a page.

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\$2.40 a line, minimum 3 lines.

POSITIONS WANTED undisplayed rate is  
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Box Numbers—Count as one line.

Discount of 10% if full payment is made  
in advance for 4 consecutive insertions.

### WIRE and CABLE WHEN YOU NEED IT

From Chicago you can get immediate  
delivery on all types of Electric Cable.  
Order today. We ship same day.

Send for our latest stock sheet

**UNIVERSAL WIRE & CABLE COMPANY**  
2919 N. Paulina St. Chicago 13, Ill.  
Branches: Los Angeles—Houston—Denver

### Equipment Used

1,600 Daybrite #4F201-4 Lighting Fixtures  
Excellent condition—\$10.00 each

**FICKIE ELECTRIC COMPANY**  
1514 Cherry St. Kansas City, Missouri

### BUSINESS OPPORTUNITY

An Exceptional Business Opportunity located  
between Harbor Springs, Michigan and  
Potoskey, Michigan and known as Stutsman  
Electric Motor Company. New building  
completely equipped on main highway and  
package price even includes late model  
house trailer. Business well established and  
showing very satisfactory gross and net.  
Address all inquiries to the Colwell Agency,  
Potoskey, Michigan.

## ROTATING EQUIPMENT

[From PAGE 120]

transformers can usually be located  
in some remote location, the result  
is a substantial savings in space  
with respect to the motor gener-  
ator. Fig. 4 shows the usual  
weights and dimensions for several  
standard converter ratings. A  
typical rotary converter installa-  
tion is shown in an accompanying  
photo.

Having but one armature results  
in a converter efficiency higher than  
that of the motor-generator set  
(usually from 3% to 5% higher)  
as indicated on the graph.

Rotary converters are essentially  
unity-power-factor machines. Vary-  
ing the field excitation changes the  
power factor, and to some extent,  
the dc voltage. However, since op-  
eration of the converter at power  
factors less than 95% results in  
excessive heating, the degree of dc  
voltage control possible by field  
control is limited to approximately  
5%. While the rotary converter  
can furnish some correction for  
system lagging power factor, it  
cannot at the same time carry full  
rated dc load without excessive  
heating.

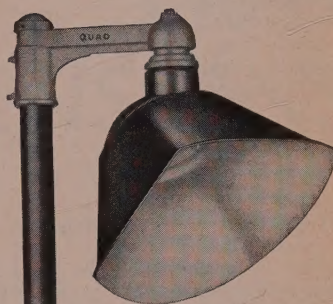
The nameplate duty cycle of ro-  
tary converters for industrial duty,  
corresponds to those of the motor-  
generator sets. Likewise, the mo-  
mentary current-carrying ability  
is limited by its commutating abil-  
ity and its ability to stay in step  
with the supply-voltage frequency.  
In addition, the permissible tem-  
perature rises and maximum am-  
bient temperatures are identical  
to those described for the motor  
generator set.

Switchgear associated with the  
operation of a rotary converter is  
similar to that associated with the  
synchronous motor-generator set.  
Suitable protective devices such as  
overspeed switch, reverse-polarity  
dc voltage relay, and overcurrent  
and undervoltage relays provide  
adequate protection against faulty  
operation.

Installation and maintenance re-  
quirements of rotary converters  
are similar to those of the motor-  
generator set. Suitable means, such  
as a chain hoist, should be provided  
for handling of the armature in the  
event it has to be removed from the  
machine.



**FOR**  
*Natural*  
**FLOODLIGHTING**



300— 500 W  
750—1500 W

**INCANDESCENT**

**RECTANGULAR  
ROUND  
ELLIPTICAL  
SCOOP  
REFLECTOR SHAPES**

- Porcelain Enamel Finish
- Cast Aluminum Slip Fitters
- Swivel Socket Head
- Enclosed Wiring

WRITE FOR  
**CATALOG No. 9A**

**QUADRANGLE MFG. CO.**

32 S. PEORIA ST.  
CHICAGO 7, ILLINOIS



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